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THE PROPERTIES OF ASPHALTS.

PROF. DE SMEDT'S REPLY TO CAPT. TORREY.

In answer to Captain Dolphus Torrey's comments on my article in issue of November, 1893, of your valuable magazine, by which I invited discussion on asphalts, I am happy to discuss the exceptions he takes.

Capt. Torrey criticises me for using the names retine, petrolene and asphaltene, although these names are technically recognized in the scientific world, and designate the hydrocarbons soluble in the solvents mentioned in my little article. He remarks: "with the present knowledge of them it would be better not to use these misleading names, but others more appropriate." It seems strange that Capt. Torrey should find fault with me for something I am not entitled to. I humbly confess that I am not the author of these names, which I do not consider to be misleading, and have no others to offer. If the Captain has something better to put in place of them, he is entitled to do so; but let it be understood that this question can not be decided between the Captain and myself, but only between Capt. Torrey and the scientific world in general.

Capt. Torrey divides his remarks into two series: first, obscurity of the language used; second, demonstrated facts of the case. I will thus follow Capt. Torrey's system and begin with what he calls obscurity of language and misleading; as to misleading, I think I have reason to state that the real "misleading" is made by our friend Capt. Torrey, though possibly not intentionally. He should give proofs and explanations in order to give some foundation to the statement made at the end of his article, to which I will refer later and will discuss.

"Compressible at 60° F."—No special condition as to force ap-

plied being given, is generally understood to be the compression by hand.

Speaking about retine, petrolene and asphaltene, Capt. Torrey says: "Technically the language used conveys in places an idea that these substances are specific hydrocarbons, while in other places they are referred to as compounds—the last is correct." In my article I say that the knowledge of these compounds is due to the important investigations of Messrs. Lebel & Munz. If "compounds" is correct, why so many useless words? To prove what?

The word "adhesive" is used knowingly, with its natural meaning as found in all good dictionaries, and not the meaning of cohesion, as the captain seems to think.

Captain Torrey states that an asphalt is artificial after it has been refined. My opinion is that a natural asphalt, after it has been refined, is a refined natural asphalt, and not an artificial asphalt.

Specific gravity was taken with refined asphalts.

The analyses of Trinidad and Bermudez asphalts were made with refined asphalts, which is easily seen by the absence of water, which might amount in crude to from 18 to 25 per cent., as the captain knows, I suppose.

The heading of my analysis is as follows: "As the most important supplies of asphalt are the Bermudez and Trinidad, I shall compare the several characteristics which I find in each. No mention is made of asphalt cement, so no mistake is possible in regard to it, as the captain seems to think. The percentage of oil is calculated to the pure bitumen, as already stated in my article. I hope I have thus answered the first series of Captain Torrey's exceptions by giving full explanations."

Now, I will discuss the so-called demonstrated facts of the case. In regard to free sulphur, Captain Torrey's reference to "Mr. O. Hesse's (arch. pharm.) experiments, shows that sulphates and sulphides are present in asphalt only in very small quantities, whereas organic sulphur exists to the amount of 10.85 per cent., and adds that sulphur is not found free in asphalt."

I judge the above analysis as being correct, but it is no argument contradicting my finding of free sulphur in a sample of Lake Trinidad asphalt. Free sulphur, like all the other impurities, such as

chlorides, sulphates, sulphites, sulphides, borates, phosphates, iodides, silica, etc., etc., found in the impurities of many asphalts, are accidental natural mixtures, but are not in combination with the asphalt, so that it is no wonder not to find the same impurities in all asphalts—some even are found almost C. P.

In the water of crude Trinidad asphalt, free sulphur has often been found. Deposits of free sulphur are seen about the rents in the Trinidad Lake asphalt. I am now examining this question, and when further advanced I will give the benefit of my labors to the readers of PAVING AND MUNICIPAL ENGINEERING.

Captain Torrey states that his "laboratory work has demonstrated that Bermudez asphalt will give off much sulphurated hydrogen at temperature below 250° C."=480° F. Such temperature is a destructive one, decomposing some of the sulphurated hydrocarbons into sulphureted hydrogen and carbon, or into asphaltene and sulphureted hydrogen.

Oxygenated asphalts at this temperature might set free carbon or form asphaltene and water.

So the Bermudez, the Egyptian and the Trinidad asphalts, being of the series of sulphurated asphalts, it is no wonder that some sulphuretted hydrogen escapes when submitted to high temperature.

The elementary analyses were made with C. P. Bermudez asphalt and C. P. Trinidad. The results were almost similar. On this point Capt. Torrey remarks: "It will be observed that there is no percentage of nitrogen nor of oxygen, which are supposed to be universally present in asphalts."

Nitrogen is sometimes found in asphalt. Its presence might be attributed to the decomposition of organic matter not bituminous, but as a general fact, the nitrogen is eliminated as ammonia during the operation of refining. In Trinidad and Bermudez asphalts no oxygen is found, provided they are free from all impurities—water, salts, oxides, etc., etc.

Quotation from Capt. Torrey's exceptions: "Concerning the proportion of the asphalt soluble in alcohol, the writer obtains very different results."

I obtain results, as stated in my little article, working with alcohol ethylic and refined Bermudez asphalt at ordinary temperature, and by following some necessary principles.

Quotation by Capt. Torrey: If there are defective conditions in

a refined asphalt, they may be fully remedied in the preparation of cements." And further, "When cement is made, its properties of softness, pliability, etc., are matters for consideration and comparison, regardless of what these things may have been in the asphalt from which the cement is manufactured." This seems to mean that all asphalts are suitable and alike good for asphalt pavements, provided they have been refined and tempered with petroleum oil to a certain consistency. This, without a proof given, is a misleading statement, which, if followed, might have disastrous consequences for the contractor and for the reputation of asphalt pavements.

It is a well known fact that there are a great many asphalts unfit for asphalt pavements. This is known by all asphalt experts and practical men in that business. Years ago, positive, practical proofs were given in Washington, D. C., by order of Major Twining, then engineer commissioner. On several streets sample pavements were laid, under my direction, having for matrix different asphalts, hard, medium and soft, and the wearing results were, hard asphalt bad, medium better, soft good. It is well understood that all these different asphalts were brought to similar consistency by the addition of heavy petroleum oil.

It has been often proved that an asphalt yielding an excess of asphaltene is not fit for asphalt pavements, and that asphalt, having lost its petrolene by evaporation or otherwise, its good quality can not be restored by the admixture of heavy petroleum oil.

Capt. Torrey claims that the Bermudez asphalt is not better because of its lesser percentage of mineral matter. If the impurities in an asphalt do not contain detrimental substances, his reasoning might be admitted. But it is a well known fact that the refined Trinidad asphalts contain detrimental impurities, such as soluble salts, certain sulphides and organic matter not bituminous, so that the claims of Capt. Torrey are not well founded.

E. J. DeSmedt.
Biograghical Sketch in November Number, 1893, p. 208.

In regard to artificial and natural mixing: The process of artificial mixing being so easy and simple, and since any one can easily demonstrate the fact, I will not discuss this point any longer.

E. J. DeSmedt, Chemist.

PHYSICAL PROPERTIES OF ASPHALT.

THE "softness" of an asphalt, or of a cement made with it, varies according to its degree of fluidity, and this changes with its temperature. The cohesive strength of an asphalt varies with its fluidity throughout the range of its viscous condition. It is found practicable to define, in thermometric degrees, the differences in fluidity between two or more samples of any of the asphalts and their cements. In doing this the temperature at which the samples have a cohesive strength of one hundred pounds for a sectional area of one square inch is ascertained. Any other degree of strength could be used for this purpose, but preference is given to the one named on account of convenience in testing, ascertained by experience.

The writer has invented and uses an instrument called a tractor, with which test pieces of asphaltic cement, etc., are with the utmost facility prepared so as to have uniform density and dimension; and the tests of strength are made with a specially devised apparatus which registers in each case the breaking strain of the sample. The results secured harmonize well and give satisfactory evidence of the sufficient accuracy of the results obtained. The following data are transcribed from the writer's laboratory records to illustrate the results secured in tests of this character:

A strength of one hundred pounds per square inch of area is, for the material named, found at the respective temperature as follows: Crude cheese pitch, 214° F.; refined cheese pitch, 203° F.; cement from pitch, 118° F., which reads that the refined asphalt was 11° more fluid than the crude; and that the cement was 85° more fluid than the refined.

There are co-efficients of changes in the fluidity, depending respectively upon the temperature, inorganic admixtures in it, and upon the percentage of certain component groups of its hydro-carbon elements, concerning which publication will be made in due time.

DOLPHUS TORREY. Biographical sketch in April Number, 1894, page 195.

It is found in these tests that the fractures of test pieces differ greatly, under varying conditions, and present appearances which lead to their classification as viscous, earthy, vitreous and crystalline or dendritic, and concerning which something is to be said in the future. *Dolphus Torrey.*

BRICK PAVED STREETS AND ROADS.

One of the greatest signs of civilization is roads; hence the ancient proverb, "All roads lead to Rome." This was because Rome was at one time the center of civilization. In these modern days, all roads lead to our commercial centers. Water, rail and highways, all point to some great central mart. The railways, both steam and electric, are making progress in keeping with this, the most progressive of all ages, while our highways, in many cases, are much more dilapidated than they were a few decades ago. They show less improvement than anything we have to do with, while they are a constant and heavy source of expense to the farmer, and consequently to us all as consumers, for at the very time the producer has plenty of leisure and can get a fair price for his product, he is unable to move it to market. Our present extravagant and reckless manner of keeping up our roadways, by working out our taxes, hauling stone and gravel in the fall to be carried away in mud in the spring, is perhaps one of the most wasteful means of applying the public funds and energies of anything on the statutes of our country, and really where it can be spared the least. But this has been the custom for ages, and all seem to look at it as though it were the proper thing to do; and when some suggestion is made to better the condition of things, the plea is made that all other ways and means are too costly. 'Tis said that desperately bad cases require desperate and radical remedies, and our road case is no exception to the rule.

The city of Norwalk used to pay $12,000 per annum for keeping up this old custom. They resolved to pave, and soon found that their cleaning and repairing fund was not nearly used up, and so continued to pave a few streets every year, until now they have but little need of a repair fund, but have transferred that amount to pay interest on their bonds. They are now paying interest on their bonds with the same amount from street repair fund, and building, or paving, some additional streets each year. Instead of muddy and impassable streets all winter, they have one of the best paved cities in the United States; clean and pleasant to drive over at all seasons, and free from dust and noise in the summer. True, some

thought it rather hard to pay at first, but you can not find anyone now that would return to the old mud streets, even though it would cost them many times more for the improvement than it did.

One of the greatest dangers to the usefulness and establishment of this system is to guard against inferior material and workmanship, and one of the greatest drawbacks and discouragements to the city street pavements is the now visible fact that a great many soft and inferior brick were put into some of the earliest pavements.

These got in partly through ignorance and partly otherwise. No rule can be concisely drawn as to how to regulate or inspect these materials, although the absorption test is possibly among the best; then comes the rattler or tumbler test. But for such brick as could be made at a country brick-yard or tile factory, nearly all clays would act differently. Possibly a brick made of native or local clay, that has been laid in a sidewalk for a season or two, would be a fair guide, by taking it up, wash and dry thoroughly in oven heat for twenty-four hours, carefully weighing it, then place in water for twenty-four hours, and you get the exact amount of absorption. Then take your own brick and compare color and get as near as possible to same, allowing some for stain on the old brick, and you may arrive at a pretty fair standard of what is frost proof. Give the doubt always to the safe side, for a few soft brick would be the means of condemning the whole undertaking for the future.

There is no question in the minds of those who are best able to judge but that vitrified brick is the coming material for street and highway improvement. Furthermore, those that have good material for tilemaking with down-draft kilns can make brick for paving country roads with comparatively little expense by adding to their present machinery a brick die, cutting table and such other improvements as may be needed. Possibly some steam pipes will be required, to exhaust steam, as brick will dry much slower than tile, owing to their heavy bodies and more clay in a solid mass; they will also require more time to raise fire and burn, otherwise some clays will swell, puff or blacken in the center. The cooling also should be slower, as they need to anneal, or toughen—a very important item in this case.

Not that every brick in the kiln ought to be put into the pavement, but by using clean, or fire sand between the upper courses in

the kiln, to prevent sticking together, they ought to get at least three-quarters or more of good, hard brick, and realize $6.00 per thousand, and ought to sell the rest for $4.00. This will pay better than tilemaking as a rule.

The road-bed should be prepared by placing on one side of the present highway two strings or lengths of 4x6 oak, sixteen feet apart to form a curb; and stakes of 4x6, two feet long, driven with a pile driver into the road and bolted on the outside to keep in place, at intervals of six feet apart. Then round between the curbing with gravel, stone, slack or cinders or coarse sand, giving it some four inches of a pitch. This should be well rolled and then covered with two inches of sand and brought to a final grade, when it is ready for the brick. They should be laid on edge and paved across from curb to curb, breaking joints. Then place one inch of sand over the whole and work into the joints, followed by another rolling, and you have a country road that will last from twenty-five to fifty years, with little or no care. The ditches on both sides must be kept well opened so as to keep the foundation dry. The slight crowning of the road-bed acts as a roof over your foundation and will be as easy to travel over in wet weather or winter as in summer. The other part of the road should be left in a good condition for summer travel, as it would be better for unshod horses than the hard brick, and furthermore would save that much travel on the paved portion.

The coast of a roadway as described would vary of course in different localities, depending upon the cost of material and labor, but it should not exceed $8,000 per mile, providing that the present grade will answer. In one mile of a 16-foot roadway there are 9,387 square yards of surface. Sixty-four common brick will lay a square yard, and the mile of paving will require 600,800 brick, which at $6 per thousand, or 38$\frac{2}{5}$c. per square yard, will cost $3,604.80. Then allow five cents per square yard for hauling, ten cents for the sand and gravel, and twenty cents for the labor of preparing the road-bed and laying the brick. The curbing and posts would require 30,000 feet of oak worth about $25 per thousand feet, which, with the necessary bolts $\frac{5}{8}$ by 9 inches, would cost $850. This brings the total cost for a mile of 16-foot roadway to $7,740, or at the same estimate, a mile of 10-foot paving could be completed for $5,156. These are

liberal estimates, and in many places the work can be completed for much less than this.

In the west they use a layer of brick on their flat side under the pavement. These may be the softer, or imperfect brick, not suitable for the surface, or road proper. Possibly in very soft or boggy lands they answer a good purpose, but good gravel well rolled will answer, and will lessen the cost of the improvement, and to get this system introduced great economy must be practiced, or the cost will discourage the first attempt.

The question as to how to pay for this road-making will be asked. I would suggest that you urge your Senators and Representatives to enact a statute authorizing the auditor of state to pay 50 per cent. of the cost; also the county commissioners to issue bonds for 25 per cent., and tax the remaining 25 per cent., equally divided, on abutting lands for a distance of one mile back on each side of the improvement.

This would be so light that it would hardly be felt. Commence at or near the county seat, and construct a mile in each direction as the county commissioners may decide most judicious and most needed. A limit should be specified, say of not to exceed four miles in any one year. By adding only a few miles each year, the farms several miles out in the country would soon be as valuable as those now more favorably situated near the towns. It would be very presumptive to expect this to be carried out without changing—all new movements have crude beginnings.

Being sensitive of the fact that this is rather a new departure, should we not bear in mind that if we had adhered to sickle and scythe, as some do yet, we should be most wofully left behind in these days of close competition? When railroads were proposed through this broad land, people were nearly up in arms against such encroachments; but what would we be without them to-day? Where would our neighbors in the far west be without railroads?

There is no doubt that the improvement of our highways would be almost as great a benefit to farms as the railroads have been to the west. The dairyman, market gardener and butcher could then be out five or ten miles and get to their city customers quicker than they do now, living only a mile out, in the mud and rutty road of winter. In a few years the great fluctuations in the price of farm

produce would be nearly overcome. The grain could be placed near to the paved road during fall when the mud roads are good, and when time is more plentiful it could be transferred to market at a handsome profit, and when spring time comes the farmer can devote his entire time to preparing for his future crops, instead of hauling to town when possibly the market is already glutted with corn, grain, hay, etc.

His children could live at home and derive the benefit of city education. It would elevate the family moral, social and financial condition, and thus greatly enhance their usefulness, health and happiness.

A. O. Jones.

ATHELSTAN O. JONES was born in Montgomeryshire, Wales, March 10, 1842, and when about seven years old moved with his parents to near Shrewsbury, England, where he was educated at Kingsland academy. In 1867 he came to Ohio, and entered the employ of the Columbus Sewer Pipe Co., filling nearly every position with this company, and becoming thoroughly experienced in the business, and familiar with the details of every department. When the Wassall Fire Clay Co. began business in Columbus, he was engaged with them as foreman and contractor in the manufacture of fire brick, sewer pipe, etc. In 1879 he organized his present company in Columbus, making drain tile and brick. He was the first to use a steam press for making large drain tile. After experiencing two disastrous fires, the last one shortly after remodeling and equipping his factory with all new machinery for the manufacture of sewer pipe, he decided to change his location. Going to Europe, he visited most of the largest clay industries there, noting any of the new improvements that might be of value, and after returning home, visited the leading factories of the United States. From some twenty sites inspected with a view to a permanent location, he selected the present one at Zanesville, Ohio, where the A. O. Jones Brick and Terra Cotta Co., of which he is president and general manager, have a model plant. The thirty five acres of land on which the plant is built was donated to the company by the Board of Trade, of which Mr. Jones is now serving his second term as president. He was appointed by Governor McKinley as one of the Ohio Commissioners to the World's Fair.

VELOCITY AND DISCHARGE OF SEWERS.

MR. ANDREW ROSEWATER, of Omaha, has prepared a very valuable table of computations of the velocity and discharge of sewers, which is here reproduced. Mr. Rosewater has discovered that in the original complicated Kutter formula, after computations of velocities and discharges are made for all sizes of sewers upon a grade of one per cent. that the same sewers, upon any other grade, will discharge with velocities and in quantities practically proportionate

to the square root of the grade. Fully 90 per cent. of labor in sewer computations will be saved by use of his table, and in view of its simplicity results can be obtained without reference to numerous columns of factors or logarithms.

Table of Velocity and Discharge of Circular Conduits Based on Kutter's Formula. n equals .013. Grade equals 1 in 100 (or s equals .01).

Ft. Diam. In. of Condt.	Veloc. in ft. per second.	Disch. in cu. ft. per sec.	Ft. Diam. In. of Condt.	Veloc. in ft. per second.	Disch. in cu. ft. per sec.
4	1.81	0.16	7...0	16.98	653.4
6	2.52	0.49	3	17.37	717.2
8	3.17	1.11	6	17.77	785.1
9	3.47	1.53	9	18.12	854.7
10	3.77	2.05	8...0	18.50	930.0
1.... 0	4.34	3.40	3	18.87	1008.9
3	5.12	6.29	6	19.25	1092.4
6	5.87	10.37	9	19.57	1177.1
8	6.35	13.85	9...0	19.94	1268.6
9	6.57	15.79	3	20.29	1363.7
10	6.80	17.94	6	20.65	1463.7
2.... 0	7.24	22.74	9	20.96	1565.0
2	7.67	28.27	10...0	21.31	1673.7
4	8.08	34.53	3	21.65	1786.2
6	8.48	41.64	6	21.99	1903.9
8	8.88	49.59	9	22.28	2022.7
10	9.26	58.36	11...0	22.62	2149.6
3.... 0	9.63	68.09	3	22.94	2280.5
2	10.00	78.78	6	23.27	2417.0
4	10.36	90.39	9	23.56	2554.3
6	10.71	103.00	12...0	23.88	2700.5
8	11.05	116.80	3	24.19	2850.8
10	11.39	131.50	6	24.50	3007.0
4.... 0	11.73	147.40	9	24.77	3163.6
2	12.07	164.50	13...0	25.09	3329.9
4	12.39	182.70	3	25.39	3500.3
6	12.71	202.20	6	25.69	3677.3
8	13.01	222.40	9	25.95	3854.3
10	13.31	244.20	14...0	26.25	4041.9
5 ... 0	13.62	267.50	6	26.84	4432.2
2	13.94	292.10	15...0	27.39	4839.9
4	14.23	317.80	6	27.95	5274.5
6	14.53	345.10	16...0	28.48	5726.8
8	14.78	373.00	6	29.03	6208.4
10	15.07	402.80	17...0	29.55	6707.1
6.... 0	15.36	434.30	6	30.08	7236.3
3	15.78	484.20	18...0	30.58	7783.1
6	16.20	537.70	19...0	31.59	8958.4
9	16.57	593.10	20...0	32.58	10236.0

Table of Grades per 100 and their Square Roots.

Grade per 100.	Square Root of Grade.	Grade per 100.	Square Root of Grade.	Grade per 100.	Square Root of Grade.
.04	.200	1.20	1.095	3.15	1.775
.05	.224	1.25	1.118	3.20	1.789
.06	.245	1.30	1.140	3.25	1.803
.07	.265	1.35	1.162	3.30	1.817
.08	.283	1.40	1.183	3.35	1.830
.09	.300	1.45	1.204	3.40	1.844
.10	.316	1.50	1.224	3.50	1.871
.11	.332	1.55	1.245	3.60	1.897
.12	.346	1.60	1.265	3.70	1.924
.13	.361	1.65	1.285	3.80	1.949
.14	.374	1.70	1.304	3.90	1.975
.15	.387	1.75	1.323	4.00	2.000
.16	.400	1.80	1.342	4.20	2.049
.17	.412	1.85	1.360	4.40	2.098
.18	.424	1.90	1.378	4.60	2.145
.19	.436	1.95	1.396	4.80	2.191
.20	.447	2.00	1.414	5.00	2.236
.22	.469	2.05	1.432	5.20	2.280
.24	.490	2.10	1.449	5.40	2.324
.26	.510	2.15	1.466	5.60	2.366
.28	.529	2.20	1.483	5.80	2.408
.30	.548	2.25	1.500	6.00	2.449
.35	.592	2.30	1.517	6.50	2.550
.40	.632	2.35	1.533	7.00	2.646
.45	.671	2.40	1.549	7.50	2.739
.50	.707	2.45	1.565	8.00	2.828
.55	.742	2.50	1.581	8.50	2.915
.60	.775	2.55	1.597	9.00	3.000
.65	.806	2.60	1.612	9.50	3.082
.70	.837	2.65	1.628	10.00	3.162
.75	.866	2.70	1.643	11.00	3.317
.80	.894	2.75	1.658	12.00	3.464
.85	.922	2.80	1.673	13.00	3.606
.90	.949	2.85	1.688	14.00	3.742
.95	.975	2.90	1.703	15.00	3.873
1.00	1.000	2.95	1.718	16.00	4.000
1.05	1.025	3.00	1.732	17.00	4.123
1.10	1.049	3.05	1.746	18.00	4.243
1.15	1.072	3.10	1.761	20.00	4.472

METHOD OF USING THE TABLE.

To find the velocity and discharge of a 3-ft. 8-in. sewer on a 2.25 per cent. grade. Find the velocity and discharge as given in the table opposite 3 ft. 8 in. and multiply them by the square root of 2.25.

Thus 11.05 multiplied by 1.5 equals 16.57, the required velocity.

Thus 116.8 multiplied by 1.5 equals 175.20, the required discharge.

When the velocity and discharge is desired for different values of n then (n equals .013) very good approximate values can be deduced as follows:

for n equals .011 multiply tabular quantities by 1.20
for n equals .012 " " " " 1.09
for n equals .015 " " " " 0.84
for n equals .017 " " " " 0.73

These can be used with a limit of error of 10 per cent. and it is only in the extreme cases where the error exceeds 5 per cent.

The above approximations give excessive values for small diameters and insufficient values for large diameters.

A NOVEL SIPHON.

DURING the spring of 1892 in a conversation with Mr. Rudolph Hering on matters pertaining to the sewerage of Roanoke, in speaking of siphons Mr. Hering suggested a plan of using two or more pipes instead of one, as is the common practice; the general idea being to reduce the volume of water and increase the velocity. The idea seemed such a practical one that, having occasion since to connect two lines of sewers emptying into Lick Run on opposite sides, it was put into practice.

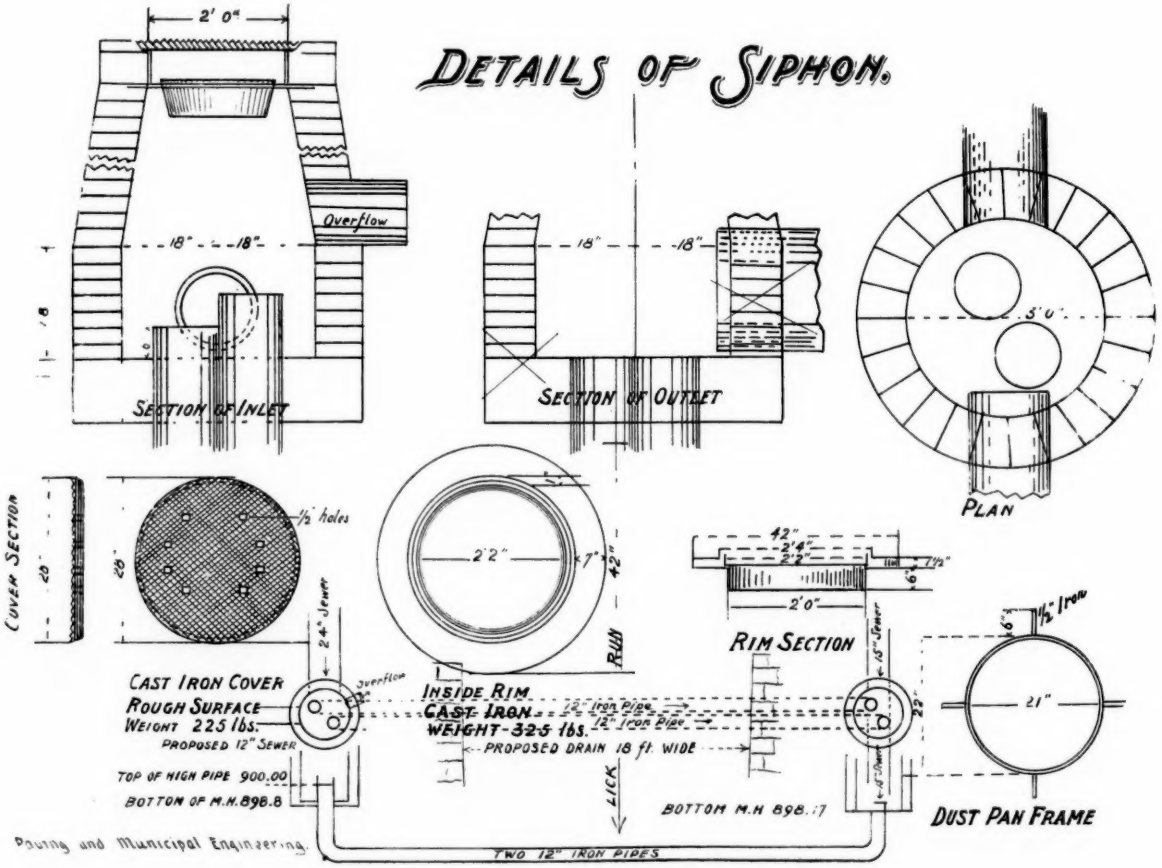
The accompanying drawing made in the office of Mr. W. M. Dunlap shows the plan of the siphon, the novelty of construction being in the use of two twelve-inch pipes of unequal height, in the intake manhole. When the lower pipe is tested to its full capacity the water rises to the level of the higher pipe, thus insuring a full flow through the pipe with the lower intake and by its velocity preventing the accumulation of sediment aud liability to stoppage. This siphon has been in operation now more than one year and has fully served the purpose for which it was intended, without giving any trouble whatever. As the amount of water it accommodates varies owing to the admission of considerable storm water to one of the sewers it would seem to answer these conditions very well. Provision is made for any extraordinary flow of storm water through the twenty-four-inch sewer by an overflow from the intake manhole. So far as I know this is the only siphon ever constructed on this principle and the working of this would seem to indicate that it is well worthy of Mr. Hering's inventive genius in such matters.

Clarence Coleman,

Member Board of Public Works, Roanoke, Va.

CLARENCE COLEMAN was born at Jerdone Castle, Louisa county, Virginia, April 4, 1849. He received his collegiate education at the Virginia Military Institute and the Washington and Lee University. He commenced practice on the Houston and Texas Central Railway in 1870 and has been variously employed upon engineering projects since that time. He was an engineer on geological surveys in northwestern Texas, assistant engineer of the Richmond and Allegheny Railroad and of the Chesapeake and Ohio Railway, engineer of the Virginia Sulphur Mines Company, engineer of the Arminius Copper Mines Company, chief engineer of the Housatonic Railroad, chief engineer of the Sante Fé Southern Railway and has been in private practice in Roanoke, Virginia. At present he is a member of the Board of Public Works in Roanoke. Mr. Coleman is also a past president of the Association of Engineers of Virginia.

DETAILS OF SIPHON.



Paving and Municipal Engineering.

MAINTENANCE COST OF STREETS INCREASED BY CAR TRACKS.

It is generally acknowledged by men familiar with traffic and its injurious effects upon our streets, that when a car track is laid in any ordinary width street it quickly increases the cost of maintenance and makes it impossible to keep the road in good condition for travel.

Whatever road material you use, be it granite blocks, asphalt, brick or crushed stone, the poorest costs the most for maintenance. With the introduction of electricity as a motive power, the mileage of street car tracks is increasing rapidly and they will soon have the main arteries of our cities and towns girdled with electric railways. I have selected a few macadamized streets under various conditions of traffic in different parts of the city of Springfield, Mass., of which I can get a perfect record from the books of the highway department, for the purpose of illustration and comparison:

COMPARATIVE TABLE OF COST. BEFORE TRACKS WERE LAID.

Name of Streets.	Average macadamized width.	Length in ft.	No. of square yards.	Cost of repairs for a term of years.	Years.	Average annual cost per lin. ft.	Average annual cost per sq. yd.	Average annual cost per mile.
Dwight street	31.0	2,323	7,953	$1,499.15	14	$.046	$.0134	$243.00
Emery street	21.5	648	1,541	386.20	21	.028+	.0119+	148.00
Franklin street	24.5	1,570	4,296	982.37	19	.033	.012	174.00
Hampden street	27.7	607	1,866	770.06	23	.055	.018	290.00
Market street	12.8	961	1,376	374.71	28	.014	.0097+	74.00
Pynchon street	22.7	868	2,148	360.59	19	.0218+	.0088+	115.00
Water street	23.7	5,145	13,546	3,435.82	12	.055+	.021+	290.00
Central street	23.0	3,993	10,227	925.70	6	.0386+	.015	204.00
Maple street	23.0	2,154	5,569	643.67	10	.03	.0115+	158.00

AFTER TRACKS WERE LAID.

Central street	17.0	3,993	7,482	$5,332.61	14	$.095	$.051	$502.00
Maple street	16.4	2,154	3,916	4,105.82	14	.136	.075	718.00
St. James avenue	28.5	2,042	6,467	913.01	1	.447	.141+	2,360.00

From the foregoing figures we find that on residential streets with a moderate traffic and driveway of thirty feet from curb to curb, unencumbered with street car tracks so that the traffic is distributed over the entire surface, it is possible to furnish the traveling public with a good surface of macadamized pavement at an

average annual cost of .013 per square yard for maintenance. On the other hand, when you put a track in the center and confine the traffic to a narrower space each side, the horses and wagons constantly traveling in the same place will, with the immense pressure per square inch brought to bear, grind the pavement into dust and mud. When you place a car track in the center of a street it occupies a portion that was originally intended, when the pavements were first laid, to carry the bulk of the traffic. Under these conditions it is not at all surprising that on a street which receives but a moderate traffic the cost of maintenance with no track in the center is increased from .013 to .063 with a track in the center. These figures are the average for fourteen years. The average cost of maintenance on Dwight street is .0134, on Water street .021. These streets have no car track in center, are in a business portion of the city and receive a heavy traffic, yet the cost of maintenance is small compared with Maple and Central streets, which are residential streets. These two streets have a car track in center and receive only a moderate traffic, but the average annual cost of maintenance is .063 per square yard, or $610 per mile. Summer street, the approach to the New England freight depot, was macadamized in the summer of 1892, and is subject to a very heavy traffic, though the cost of maintenance annually is only .005 per square yard, while on St. James avenue, macadamized the same year as Summer street, and one of the main arteries in the residential portion of the city, but receiving only an average traffic, has a car track in the center, and costs .141 per square yard.

Of course, it must be understood that these results are obtained by the use of a fine quality of trap rock which comes from the quarries at Westfield and Meriden, Conn., and is as good material for macadamizing streets as there is in the country. Undoubtedly with poorer materials the cost of maintenance would be greatly increased, especially with the traffic confined to a narrow space each side of a car track.

Reviewing the lesson which the past five years have taught, I am most firmly convinced of the great necessity of street superintendents and officials in charge of our highways devoting more time to the careful tabulation and recording of all expenditures, the methods employed in laying the pavements, the foundation, width

of street, whether a car track is in the center or not, a record of the traffic or anything pertaining to street work in general. This should be so carefully done that at a very short notice the actual cost of construction and maintenance or any information required about a street, or any part of a street, could be given.

W. L. Dickenson.

COMPOUNDING CONCRETE.

I HAVE been much interested in reading the articles in recent issues of PAVING AND MUNICIPAL ENGINEERING on the theory of concrete construction. The different experiences therein detailed are very gratifying, as it adds an iota to the very scanty information available on concrete construction. I must demur, however, to the acceptance of the recipe as there detailed. Whatever success there was must have been due to sheer luck. It is misleading to suppose that a recipe for a mere mixture of cement with sand and stone will produce an article equalling the natural stone. Much has to be learned before concrete as a material for foot pavements is perfected, but that can most readily be learned by each doing his own work and exchanging experience. Concrete for foot pavements has its own field, and within well marked limits its use is advisable, but until its capabilities are more largely tried and its usefulness increased, the full advantage will not be obtained from it.

There are many technicalities to be considered in the compounding of concrete. A first-class cement when improperly incorporated with unsuitable aggregates will never attain satisfactory results. The aggregates, like the cement, should be the best of their kind, entirely free from dust and other foreign matter. They should be sharp and angular and of such size that will readily form a compact mass when rammed into position. The different materials should be compounded generously and separately and not thrown in an indiscriminate mass.

The application of water is another feature well worth noting, for the reason that as much injury may be done by too little as too much. It should be gradually applied in form of a sprinkle, and

not allowed to be applied in large quantities at a time, as it will wash and drown the cement from the compound.

Warner H. Jenkins, C. E.

WARNER HADDON JENKINS was born in the city of Philadelphia, Pennsylvania, on the 27th day of February, 1863. At the age of seventeen he entered the university class, where he studied mechanical and civil engineering, finishing his course by private tuition. In the year 1880 he entered the paving business as an apprentice to one of the largest contractors of that time. After thoroughly mastering the various technicalities of the business, he, in 1881, established the Portland Paving Company, which he has served as general manager and superintending engineer for the past eight years, besides acting as consulting engineer to several large companies in Pennsylvania and New York states. He is the patentee of the Metalithic process, and was the means of establishing the Metalithic Paving Company of New York City. He has been identified with some of the largest concrete constructions in his state, and is now retained by the Philadelphia Municipal Association as an expert. In December, 1892, he formed a partnership with Andrew M. Eastwick, under the style of Warner H. Jenkins Co., to do a general business of engineering and contracting.

CURRENT INFORMATION.

THE PAVING PROBLEM AS IT IS VIEWED IN MINNEAPOLIS.

The city of Minneapolis now has 63.1 miles of cedar block paving, all put down on a plank foundation, 2.77 miles of asphalt, 9.49 miles of granite blocks on sand foundation, and two miles of macadam. The total length of street is 800 miles. In reviewing the investigation of the paving question made by the two council committees which visited a number of the leading cities during the last year, City Engineer Cappelen says in his annual report: "The price of cedar paving as put down at present is only about eighty-five (85) cents per square yard, but I would respectfully recommend that in the future cedar paving should be put down on a concrete foundation with joints tarred. The price would be one dollar and forty-five cents ($1.45) to one dollar and fifty cents ($1.50) per square yard, but when the blocks are worn out, the cost of replacing them on the concrete foundation would be but seventy-four (74) cents per square yard.

"Proposals were received in December for the granite paving ordered for 1894, and the astonishing price of one dollar and fifty-eight cents ($1.58) per square yard was submitted by the lowest bidder. The principal features of the specifications, upon which the proposals were made, were, the necessary grading, with back filling of four (4) inches of sand, rolling of foundation, blocks to be from three and one-half (3½) inches to five (5) inches in width, ten (10) to twelve (12) inches in length and seven (7) inches deep, sandfilling of joints, ramming and rolling of the blocks and finally a top dressing of pea gravel. The wearing surfaces of the blocks are not to have variations to exceed three-eighths (⅜) of an inch from the horizontal plane.

"In several cities granite blocks are laid upon a concrete foundation. The experience in Minneapolis with granite blocks laid upon a sandy soil has proven, however, that it is unnecessary to go to the extra expense of providing a concrete foundation in this city. By specifying that the blocks shall be from three (3) inches to four (4) inches in width, and the wearing surface practically smooth, the cost of the pavement would probably not be increased in price by more than thirty (30) cents, which would make a total price per square yard of one dollar and eighty-eight cents ($1.88). For future work I would recommend that the changes referred to be made.

"Our asphalt pavement cost us on the five (5) year guaranty plan two dollars and seventy-five ($2.75) cents per square yard. In my opinion the best paving brick is manufactured in Ohio with Illinois a close second. Owing to the great distance from these markets, the freight expenses add so much to the cost of the brick pavements that it will be very questionable if brick can be adopted in Minneapolis in competition with cedar and granite

It appears, however, that the proper clay for paving brick is to be found near our city. Samples of the Coon creek clay have been sent to Ohio and burned there with excellent results. Clay from Monticello has also been sent to Ohio for burning and examination in general. I have not yet received the results, however, but expect them to be favorable.

"The following analyses show the chemical character of Columbus, Ohio, Galesburgh, Ill., and the Coon Creek, Minn., clay:

	Silica.	Alumina.	Perox of Iron.	Lime.	Magnesia.	Potash and Soda.	Water.	Undetermined.	Total.
*Columbus, Ohio.	66.30	18.62	9.78	0.4	0.84	1.89	....	2.17	100
*Galesburgh	68.69	17.95	7.25	0.76	1.47	2.83	....	1.05	100
Coon Creek.....	60.31	23.77	7.96	....	....	2.41	5.55	....	100

Mr. Cappelen's conclusions as to the comparative merits and cost of the various kinds of pavements are given in his report as follows:

"The following table will illustrate the relative cost of the various kinds of pavement for a term of say twenty (20) years, total interest at 5 per cent. included, upon a street with a traffic, like Nicollet avenue, the tonnage of which is about 150."

Class of Paving.	Cost per Sq. Yd.	Cost of Renewal	Years Wore.	Actual Cost Per Yr.	Value of Pavement at the End of 20 yrs. per sq. yd.	Net Cost per sq. yd. per Year.
Cedar, 2-inch plank foundation without tar.	$0.85	$0.79	6	$0.29	⅔ of .79 = .53	$0.26
Cedar, concrete foundation with tar.....	1.45	.74	8	.30	½ of .74 = .37 / concrete, .67 } 1.04	.25
Granite.....	1.88	1.88	20	.25	$0.60	.22
*Trinidad Lake asphalt.....	2.75			.42	2.00	.32
Small size Minnesota brick.....	1.80	1.13	10	.33	.80	.29
Large size Minnesota brick.....	1.90	1.23	10	.35	.80	.31
†Galesburgh brick.....	2.15	1.48	10	.40½	.80	.36
†Ohio brick.....	2.70	2.03	10	.52	.80	.48

*Kept in repair for ten (10) years, after which add eight (8) cents per yard per year.
†All-rail rate for freight.

"From the above table it will be seen that as far as net cost goes various kinds of pavements range as follows: first, granite; second, cedar; third, brick (with the exception of the Ohio or Galesburgh); fourth, asphalt.

"As far as regards least resistance to traction the order would be, when the pavements are new and also old: first, asphalt; second, brick; third, cedar; fourth, granite.

"With reference to sanitation, asphalt would lead, with brick or granite next and cedar last. The same order will also prevail with reference to beauty. With reference to least noise, cedar is first, asphalt is second, brick is third, granite is fourth.

"When the pavements are all new, the most pleasant to drive over is evidently—first, cedar; second, asphalt; third, brick; fourth, granite. But after say five (5) years, asphalt would lead, with brick second, cedar third and granite last. The trouble with cedar is, that after four (4) or five (5) years of age, the blocks are rounded off and become rough and uneven, owing to the sap wearing off on the edges of the blocks.

"Easiest on vehicles is asphalt

first, cedar second, brick third, granite fourth.

"Easiest on horses, first, cedar; second, brick; third, asphalt; fourth, granite.

"I believe that statistics show that horses will slip more on granite than on asphalt. Another matter of importance to be considered is the method required in renewing the pavements. Asphalt has a constant attention and is actually renewed, during the course of years, without interfering with the traffic to any noticeable extent; whereas when the proper time comes for renewing the other pavements the entire street will have to be closed for at least a block at a time. This is a great detriment to business, particularly on such streets as Nicollet avenue.

"In Berlin, for instance, it is against the law to close a street for repairs on account of interference with business.

"With reference to cleanliness, asphalt would lead, with brick, granite and cedar in succession. It will therefore be seen that quite a number of points, besides the cost, are to be considered in ordering new pavements and that as the property-owners on the respective streets carry most of the burden, they should be given ample time and opportunity to consider the matter. But the city authorities should see that only the best of the various kinds of pavement is put down, and that all sewers and water mains, with their respective connections and all other piping and conduits, are laid before any paving is done at all.

"With reference to suburban and residence streets, I think that for quite a while the city can get along very well by the use of gravel and the road roller, as has been demonstrated of late in the 8th ward.

"I am not in favor of macadam, first, because the native limestone is not the proper material for macadam; and, secondly, because macadamized roads require more care ful attention and repairs than any other known road covering. I am informed that private citizens will next spring ask permission to put down a piece of Kettle river sandstone pavement as an experiment. The blocks will be sawed to the proper size and will probably make a beautiful street, but I am afraid that the stone will prove too soft to wear and will be rather expensive."

KANSAS CITY PLANS FOR BOULEVARDS AND PARKS.

The board of park and boulevard commissioners of Kansas City, Mo., have issued their first printed report, comprising sixty pages, together with a number of maps and illustrations. Their preliminary work has been done with evident thoroughness. They have consulted with Mr. F. L. Olmsted, the eminent landscape architect, who has advised them fully as to the plans to be pursued. He has recommended the reservation of land for a large rural scenic park, but the board has decided to confine its plans for the present to the more urgently needed public squares and local parks within the city, the embellishment of certain characteristic points and the establishment of parkways or boulevards. The importance, the advantages and the charms of these proposed improvements are explained at length. "To make the most of life," the commissioners say in their report, "is the highest duty of the individual, and to permit and advance its fullest development and enjoyment is

clearly the first and greatest duty of every municipal corporation towards its citizens. Life in cities is an unnatural life; it has a tendency to stunt physical and moral growth. The monotony of brick and stone, of dust and dirt, the absence of the colors with which nature paints, the lack of a breath of fresh air, write despair on many a face and engrave it upon many a heart. How is the poor man's boy to grow into a cheerful, industrious and contented man unless he can play where play alone is possible, that is, on the green turf and under waving trees, and take with him into manhood the recollections of an innocent, joyous boyhood, instead of the impressions of dirty, white-faced and vicious gamins and their and his acquaintance with immorality and vice?"

In the construction of boulevards, the board proposes a one hundred foot boulevard, divided into a comparatively narrow roadway, say forty feet, and thirty feet of parking on each side, consisting of turf and three rows of trees on each side, with a walk say of eight feet. Where curbing is required, it will be of one piece with the gutter, and of granitoid. The paving will be of macadam, because a parkway is a special construction intended for light driving. The board also proposes the reservation of a large tract of land, centrally located, to be used for the drilling and parade of local military organizations and for large outdoor demonstrations and public gatherings, which will also afford opportunities for physical culture and athletic sports. It will be known as "The Parade." Small parks, pleasure grounds, terraces and plazas are also proposed, comprising, altogether, nearly ten miles of boulevards in length, and three hundred and eighteen acres of parks and pleasure grounds.

PAVEMENT FOUNDATIONS AND WIDTH OF STREETS.

Contrary to the fallacious idea of economy advocated by some municipal officers, Mr. Andrew Rosewater wisely raises his voice against thinner foundations for street pavements. "The foundation," he says, "being an essential feature to a durable pavement can not be reduced in depth from the minimum which practice has developed. The tendency is on the contrary toward eight-inch depths of concrete rather than six. The line of economy lies however in a decrease of space between curbs for outlying streets. Reductions from 40 and 50 feet to 30 feet between curbs were made in the past year with a material saving in taxes and ultimately in expenditures for street sweeping and repairs. I believe in purely residence streets 25 feet of paved width will answer all purposes, the remaining portion of the streets should be parked. A reduction of widths between curbs should not, however, be used as an excuse for narrowing the street and giving valuable space to adjoining property owners. Such space should be reserved, as sooner or later it may be needed for subways or for underground piping and wiring. I have for many years urged that the streets, which means the entire space used both for vehicle and pedestrian traffic, being public property, should remain under the absolute control of the public, and no occupancy of any part of the space, whether for temporary construction, for sidewalk, hitching-posts, trees or anything else, whether by individuals or parties under authority of franchise, should be allowed without a written permit."

WHEELS AND TIRES.

A carefully prepared report on country road construction was submitted to the State Road Convention of California, at its recent meeting, by Julius H. Striedinger and Otto Von Geldern, members of the Technical Society of the Pacific Coast. In the course of their thorough treatment of the subject they refer to the importance of the size of wheels and width of tires of vehicles as follows:

"The construction of the vehicle is not only of the greatest influence upon the reduction of traction resistance, but it also affects the duration of the road covering.

"Umpfenbach recommends the following wheel diameters for vehicles frequenting good roads:

"'1. For two-wheeled freight carts 5 feet 3 inches to 5 feet 9 inches.

"'2. For four-wheeled freight wagons, front wheels 3 feet 1 inch, hind wheels 3 feet 9 inches to 4 feet 2 inches.

"'These diameters should be increased from 6 to 12 inches for traffic on bad roads.'

"To prevent both the crushing of the road-metal by excessive wheel-pressure, and the destruction of the road-topping by ruts, there exist in nearly all civilized countries laws prescribing the proportion of gross-weight on wheel to tire-width.

"It is proper here to remark that in more recent times the views as to the utility of very broad tires have somewhat changed, it being generally admitted nowadays that outside of a certain tire-width a uniform transmission of pressure does not take place. The French commission, presided over by Morin and Dupuit, recommends as maximum width of tire 4¾ inches, and as minimum width 2⅜ inches. Still, without any additional detriment to the road, larger wheels with the same width of tire may be more freighted than smaller wheels. Again the velocity and construction of the vehicle should be considered. The French commission stated that a spring wagon at trotting speed does not wear a road more than a wagon without springs at walking speed.

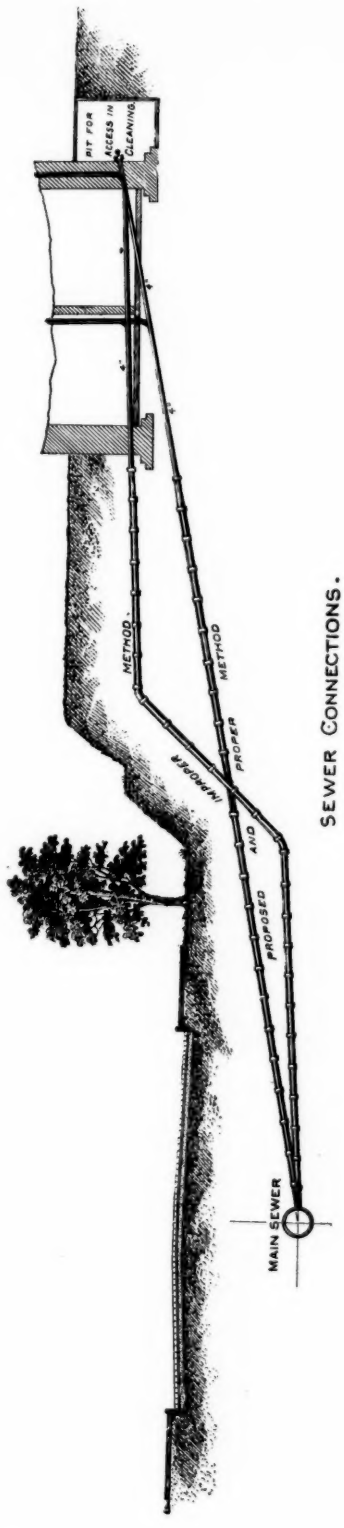
"In Hanover the width of wheel-tires for four-wheeled freight wagons is laid down by law as follows:

"When laden with 0.8 tons to 2 tons . . 2 -in.
" " " 2 tons to 3 tons . . 2¾-in.
" " " 3 tons to 5 tons . . 4-⅜in.
" " " more than 5 tons . . 6 -in.

"For two-wheeled freight cars one-half of these weights is permissible. The transportation of freights exceeding 7 tons, and of machinery of more than 10 tons in weight, is only permitted under certain conditions, which include the obligations to repair all damages done to the roadway, and to attend to all required re-enforcing of the bridges to be passed, etc. The tires should be neither concave nor convex.

"This law was very unpopular in Hanover. On that account a new bill was lately introduced making the width of tires dependent upon the number of draught horses hitched to the freight wagon. Such a law is in operation in Bavaria. It reads as follows:

"Minimum width of wheel tires of 2-wheeled carts, with 2 horses . . 4.13-in.
"Minimum width of wheel tires of 2-wheeled carts, with 4 horses . . 6.18-in.
"Minimum width of wheel tires of 4-wheeled wagons, with 2 horses . 2.60-in.
"Minimum width of wheel tires of 4-wheeled wagons, with 3 to 4 horses . . . . . 4.13-in.
"Minimum width of wheel tires of 4-wheeled wagons, with 5 to 8 horses . . . . . 6.18-in."



SEWER CONNECTIONS.

OBJECTIONABLE SEWER CONNECTIONS.

In his recent annual report, City Engineer Rosewater, of Omaha, directs attention to a common abuse in sewer connections, due, he says, to "an absence of specifications or plans, and to leaving work to plumbers or drain-layers in competition, each bidder being naturally forced to base his bid upon such plans of his own as will enable him to put the pipe under ground and out of sight for the least money, and so long as the water will run through it the owner is made to feel that it is a good job." To break up this pernicious practice, Mr. Rosewater has prepared an ordinance requiring all connections from buildings to sewers to be laid according to stakes set by the engineering department. This will protect inexperienced house owners against imposition. He also recommends that outside of a direct line to the sewer there ought to be required, wherever an angle can not be obviated, the construction of a manhole, with tight iron cover to admit of ready cleansing. The accompanying cut illustrates Mr. Rosewater's objections and recommendations.

USE OF AMERICAN CEMENT.

American cement has been largely introduced in public work in Omaha in place of Portland cement, with the result that there has been a large saving in the cost of sewer construction. City Engineer Rosewater says of the experiment, "all that is required is honest and competent inspection to force a proper proportioning of cement in the making of the mortar, and the only safe thing to do after securing competent and reliable inspectors is to place enough of them

on the work to prevent fraud in any shape. Thus it is not only necessary to have a man see the cement measured and mixed with the sand and water, but to keep an eye on the men carrying the mortar and those using it to prevent addition of sand and the use of mud where mortar should be placed. Cement testing in the past year has been applied to every barrel used on sewer work, and, as far as practicable, everywhere else where cement, mortar or concrete was used. An abstract of tests made shows that about 764 tons of Portland cement and 1,340 tons of American cement were tested, of which 2,500 barrels or 474 tons, and 20,000 sacks or 1,173 tons, making a total of 1,647 tons, were accepted; and 1,527 barrels or 290 tons, and 2,800 sacks or 167 tons, making a total of 457 tons, were condemned. The tendency to mix bad and good cements and thrust them upon the city under all conceivable brands requires stringent measures to detect frauds. I am in hopes that some method will be devised whereby this can be prevented, but am not at this time prepared to suggest any other than that of inspection as heretofore practiced."

NEW ROAD LAWS.

Gen. Roy Stone, vice-president and secretary of the National League for Good Roads, who has charge of the inquiry being made under authority of the Secretary of Agriculture into the methods of road making and management in the United States, in a recent talk relating to some of the results realized, said "that while many short sections of good highway are being built in various parts of the country, with a gratifying general cheapness in cost and freedom from burdensome taxation, yet in some of the states a serious setback to the movement has occurred through the failure of legislation intended to advance it and relied upon for great results. The optional country road laws passed in 1893 have nowhere proved acceptable to the county boards except in two counties in Michigan, and the department has asked for information and suggestions regarding other lines of legislation. Fortunately it has been able to point to the remarkable success of the state aid and local option law of New Jersey, and to commend it with certain modifications to the consideration of other States."

AN OBJECTION TO MACADAM STREETS.

Mr. A. H. Davidson, city engineer of Augusta, Ga., in his last official report speaks somewhat unfavorably of the macadam streets in that city. Referring to the recent paving, he says:

"Last year the first piece of asphalt pavement was laid, and in this year we have our first stone block pavement; now next year I suggest that we have our first brick pavement, and let that be on Ninth street, from Broad to Walker, and lay asphalt on Eighth street, from Broad to Greene. It is a loss of time and money to lay macadam on either of these streets. The traffic is too heavy, and it will soon be in holes and ruts, owing to the narrow roadway on either side of the street railroad track, besides having the gutter full of the stones to be washed into the catch basins and choking the inlet and outlet. The roadway is also covered with the loose stone, which tends to injure the horses. Besides this, the roadway is very untidy and careless looking. This, at least, is our experience with macadam heretofore. It would very much improve the

life of the roadway, vehicle and horse, and improve the looks of the streets, if these macadam roadways and gutters were occasionally raked, so as to remove these loose stones, and then re-rolled. Every macadam street in the city should be thus treated at least once a month."

HOW BRICK SEWERS WEAR OUT.

City Engineer Rosewater, of Omaha, has inaugurated a system of inspecting sewers and flushing tanks two or three times a year, the latter, "if for naught else," he says, "to clean out the sediment below the mouth of the siphons, which, from the unfiltered water alone, will soon develop several inches of mud." An examination of brick sewers developed evidences of considerable wear where they were subject to high velocities. The wear is mainly on the inner base for a width ranging from eighteen to twenty-four inches, and depths in some cases of from two to three inches. This is the result of eleven or twelve years' service, and will require a new inner layer of brick on the worn out section. A very noticeable feature of excessive erosion is developed upon the curves, the inner or shorter side invariably showing the greatest wear. Mr. Rosewater accounts for it upon the theory that the centrifugal force carries the water in an oblique position in passing around the curves, throwing the sediment to the lowest end of the section on account of the greater specific gravity, and this sediment of soil, sand, gravel, etc., concentrates all the rubbing against the brick work on the inner side, where it is massed, causing it to wear out faster than where the water alone comes in contact.

PROFIT OF MUNICIPAL OWNERSHIP OF PLANTS.

Mayor McDonald, of Austin, Tex., in his annual report, has recommended that the price of water supplied by the city be fixed at 12½ cents per 1,000 gallons, meter measurement. Assuming that the average daily consumption of water is 60 gallons per capita, he estimates that this will bring the city a yearly revenue of $68,437.50. He also recommends a charge of 25 cents per month for each 16 c. p. incandescent lamp. As the city's water and electric plants enable it to furnish power, for which many applications have already been filed, he proposes a charge of $40 per horse power per annum. He estimates that these charges will bring a total income of $153,500 per annum, "which, after deducting a reasonable amount for losses, by reason of failure to collect, would pay all of the expenses for operating and maintaining the water and electric systems and would also pay the entire interest and sinking fund on all the water-works and electric light bonds, besides paying a handsome balance into the city treasury yearly, and affording the city water for fire protection and light for its streets without cost."

COST OF AN ELECTRIC LIGHTING PLANT FOR A CITY.

The city of Minneapolis has a five years' contract with the Minneapolis General Electric Company for 100 all-night 2,000 candle power lamps, at a cost of $150 each per year and 600 moon schedule lamps at $125 each per year. There is general objection to the contract and a demand by citizens that the city shall own its lighting plant. The city has just won a suit in the

district court, setting the contract aside, but the electric company has appealed from this decision. The city council has passed a resolution authorizing the issuance of $160,000 worth of bonds to raise money for the construction of a municipal electric lighting plant. Mr. F. W. Cappelen, the city engineer of Minneapolis, has submitted to the council by request, an estimate of the cost of an electric plant, as follows:

Plant—		
Building complete	$21,300 00	
Coal chute	1,200 00	
Extra foundations	5,000 00	
12-100 light dynamos	39,600 00	
Switch boards, etc.	2,750 00	
Wiring conduits and tubing	800 00	
4 engines with condensers	33,000 00	
2 feed pumps	600 00	
1 heater	300 00	
4 boilers including Hawley furnace.	18,500 00	
1 economizer	4,200 00	
Belting	3,850 00	
4 damp regulators	600 00	
Smoke flues	1,200 00	
Shafting with clutches, pulleys and belt tighteners	5,500 00	
Piping	4,000 00	
2 horses, wagon, 2 tip cars and tools	1,000 00	
1 coal scale	100 00	
		$143,500 00
Pole line—		
4,132 35-ft. poles at $3	$12,396 00	
314 45-ft. poles at $5.45	1,711 30	
50 50-ft. poles at $7.20	360 00	
Setting 4,496 poles at $.60	2,697 60	
Shaving at 50 cts.	2,248 00	
Painting	1,900 00	
Delivering	1,300 00	
204.5 miles of wire	18,178 00	
9,000 insulators at $0.035	315 00	
Stringing of wire.	1,789 00	
9,000 pins at $0.015	135 00	
Lag screws	150 00	
726 2-pin cross-arms at $0.15	108 90	
407 4-pin cross-arms at $0.25	101 75	
404 6-pin cross-arms at $0.35	$141 40	
3,478 W. U. brackets at $0.015	52 17	
1,500 cross iron braces	60 00	
42 lightning arresters at $10	420 00	
	$44,064 12	
Add 10 per cent.	4,406 41	
		$48,470 53
		$191,970 53
837 mast arms with windlass at $20	$16,740 00	
42,000 ft. of stranded wire	900 00	
		$17,640 00
Conduit System—		
163 lamp posts at $30 set	$4,890 00	
Conduit with cable, splices, etc., and terminals complete:		
58,410 feet single cable at .56	32,709 60	
11,415 feet double cable at .72¾	8,304 41	
8 extra lightning arresters at $10.	80 00	
Relaying of paving	4,000 00	
		$49,984 01
1,000 lamps at $25.		25,000 00
Total cost of plant		$284,594 54
Operating expenses—		
4 per cent. interest and 6 per cent. depreciation of the entire investment, 10 per cent. on $284,594.54		$28,459 45
Carbons		8,000 00
Oil and waste		500 00
Fuel, best Illinois lump, at 2 lbs. per horse power per hour		13,000 00
		$49,959 45
Pay roll—		
Superintendent	$1,500 00	
First engineer	1,200 00	
Two assistant engineers, at $1,000	2,000 00	
Three firemen at $720	2,160 00	
Three oilers at $720	2,160 00	
Three dynamo tenders at $720.	2,160 00	
Three men at $500.	1,500 00	
Superintendent of line	1,200 00	
Two linemen at $720	1,440 00	
Two assistant linemen at $600	1,200 00	

Twelve trimmers at $600	$7,200 00	
One clerk at $900	900 00	
		$24,620 00
Maintaining two horses per year	$240 00	
Centrally located trimmers' distribution room, per year rent	300 00	
		$540 00
Cost of 1,000 lamps per year		$75,119 45

Or per lamp, per year $75.12, for all night and every night service.

This estimate is fair, as I have received propositions for everything specified. The depreciation at the rate of six (6) per cent. on the entire cost of plant is also liberal.

Your honorable body will remember that several offers have been made to this city by outside electrical companies, that if a contract could be made for 1,000 lights at about the rate paid now for the all-night service for, say five years, such company would build a plant, and after the expiration of five (5) years sell the plant to the city for one dollar ($1).

The following figures will show that it could be done:

1,000 lights at the present rate, $150		$150,000 00
1,000 lights at estimate of $75		75,000 00
Saving		$75,000 00
$75,000 saved per year for five (5) years		$375,000 00
Cost of plant		283,421 00
Profit		$91,579 00

According to Mr. Cappelen's estimate, the city's present expenditures for light would, in five years, pay the entire cost of a new plant and leave the city with a surplus of $91,579.

VALIDITY OF CONTRACTS FOR MAINTENANCE OF PAVED STREETS.

The committee on streets of the municipal assembly of St. Louis recently addressed a communication to the city counselor inquiring as to the validity of maintenance clauses in contracts for street construction and reconstruction. The committee held the opinion that the existing ordinance "operates in such a way as to prevent contractors from bidding as they would do if the maintenance portion of the ordinance was not included in the contract. Under this ordinance the contracts let by the board of public improvement for the construction and reconstruction of streets with wood blocks or asphaltum have included the maintenance contracts for a period of nine years, with a provision that the cost thereof shall be paid out of the fund provided for the payment of contracts for street maintenance." The committee thought that some change should be made by the board in reference to the maintenance clause, and requested the opinion of the city counselor as to whether under the present ordinance the board could insert a guarantee clause for a period of five years in all future ordinances for street improvements with the materials specified above. The city counselor held that the city ordinance providing for a maintenance clause in contracts is perfectly legal and that an agreement clause to keep in repair would be unlawful.

The difficulty suggested by the committee, which, it is claimed, presents itself in letting contracts with a maintenance clause included, is not by any means a serious one in the opinion of the city counselor. The committee claims that in lettings of this character the board has been compelled to establish a rule that no bid for maintenance in excess of fifty cents per square per annum will be accepted. If this was not done, the contractor, whose bids for reconstruction and also for maintenance must be considered in the aggregate under the charter provision, would resort to trickery in making a low bid for reconstruction and even up by a high one for maintenance, thus placing a light onus on the property-owner who pays for the reconstruction and a correspondingly heavy one on the

city which must pay for the maintenance. The question is raised, can the board limit this price for maintenance without invalidating the letting?

The city counselor holds that the board has this power. Just as the board has the power to reject a bid for construction as being excessive, so it can reject a bid for maintenance for the same reason. The fact of announcing that it will accept no bids for maintenance that exceeds fifty cents per square per annum is to be considered merely in the light of a warning to the bidders, and can not affect the validity of the letting. He is further of the opinion that these maintenance clauses should be inserted in all contracts of this kind, as it protects both the property-owner and the city. When the contractor realizes that he must maintain his work for nine years, he is careful to see that a good job is made of it in the first instance, so that there will be as few repairs to be made as possible.

The city counselor recommends maintenance clauses and holds that agreement clauses to keep in repair for five years would be illegal.

MEETING OF THE MASSACHUSETTS HIGHWAY ASSOCIATION.

The Massachusetts Highway Association held an adjourned meeting at the Quincy House, in Boston, March 17. About sixty members were present at the dinner, over which President McClintock presided. Eight new members were elected, which makes the membership more than one hundred. Many civil engineers and street superintendents belong to this organization and, although less than a year old, a great deal of good work has been done in bringing about improved methods of constructing roads and streets.

A GUARANTEE FOR CONCRETE SIDEWALKS.

Mr. Andrew Rosewater suggests that both public and private interests would best be subserved by requiring from persons engaged in the business of laying artificial concrete walks a license, with a guarantee to insure their construction and maintenance for five years under city specifications. This, he thinks, would protect many who are annually imposed upon by irresponsible persons who palm off poor materials under all sorts of guises, and whose walks disintegrate within a few months from a lack of a sufficiency of good Portland cement in the concrete mixture.

GRANITE FOR CURBING.

Minneapolis has practically adopted granite for curbing, as shown by the fact that in 1893, 4.1 miles of granite curb were set and no other kind of stone was used for this purpose. The granite curb is set in that city at an average cost of 85 cents per lineal foot. The use of gutter stone has for several years been abandoned there, except when artificial stone is used, which admits of combining the curb and gutter.

AN OVERFLOW SEWER FOR STORM WATER.

Under the direction of City Engineer Keating, of Toronto, Ont., an interesting piece of work was recently completed in that city. An old wooden sewer, consisting of a wooden box 20 x 23 inches, runs down to a wharf and continues thereon in the form of a 20-inch steel pipe, for a distance of about 300 feet. After an unusually heavy storm, this sewer became surcharged, and it was to relieve it

that an outfall sewer for storm water was designed. The new sewer lies east of the old one, and runs from a separating manhole, situated at the end of an egg-shaped brick sewer, and contains the ends of the sanitary and storm water sewers. The storm water sewer is directly above the sanitary sewer. A portion of the storm water outfall is on a steep slope and is three and one-half feet wide and five and one-half feet high and is built of brick and lined with scoria blocks and rests on a concrete foundation in the form of steps.

The outfall sewer proper is five feet high and seven feet wide, with a scoria block invert, a brick arch, and rough masonry abutments and foundation. This part of the sewer is semi-circular in cross section, while the more sloping part has vertical walls and a semi-circular top. When the quantity of sewage becomes too great to pass out to the end of the wharf, it will fill the bottom of the manhole and run off into the more elevated storm sewer, which discharges it at the shore line. Many advantages are claimed for this method of discharge.

A NEW KIND OF ARTIFICIAL STONE.

An artificial stone for paving purposes has been invented in Munich, which will, it is claimed, prove an ideal pavement. In the tests which it has undergone it seems to possess many superior advantages. Serpentine, crushed or ground into meal, furnishes the basic material; a solution, the composition of which is known only to the German firm who manufacture the stone, is added, and the mixture is pressed in molds by hydraulic power, forming stones which resemble, in size and shape, the granite blocks used in this country. They are dark brown outside, but the broken surface is gray; they are very hard and singularly elastic, for a powerful blow of the hammer will not shiver them, although struck near the edge, but will make an indentation. The stones used in Munich are made in two sixes: 10.8 x 4.4 x 6 inches, and 7 x 4.4 x 6 inches. So far as tested, the attrition of this stone is like that of the best of granite, and when worn smooth it does not become slippery. It is very little more noisy than an asphaltic pavement, and the watered surface remains damp for a long time. It yields no dust. It is claimed for it in Munich that the invention solves the question of superiority in the different paving materials.

DECISIONS RELATING TO MUNICIPAL WORK.

Liability of Water Companies for Insufficient Supply of Water. — A provision in the ordinance of a city granting a franchise to supply water to the city, requiring that the grantee shall constantly, day and night (except in case of an unavoidable accident) keep all fire hydrants supplied with water for instant service, and shall keep them in good order and efficiency, did not confer upon the owner of property destroyed by fire a right of action against said grantee, on account of its failure to furnish water as stipulated, although thereby the loss by such fire would have been obviated. Under such circumstances the grantee is not liable by reason of assuming the functions which might properly belong to the city, for the reason that under the facts stated, the city, if performing the same functions, would not be liable. Eaton *v.* Fairbury Water-Works Co., Sup. Ct. of Neb., 56 N. W. Rep. 201.

Sewerage Assessments in Municipal Improvements.—Under a village charter providing that any persons dissatisfied with the decision of the bailiffs, as to the assessment for contribution for the building of a sewer, may petition the county court for re-assessment, the court has the right to determine the right of the bailiffs to make any assessment. A village charter provided that every person whose drain entered into a common sewer should be assessed for the cost of its construction. Petitioner's grantor had paid his share of the construction of a private sewer, which was afterwards conveyed, without consideration, to the village. Petitioner was not liable to an assessment, when it became necessary to lower the sewer in order to connect it with another sewer constructed to drain another district territory. Boyden *v.* Village of Brattleboro, Sup. Ct. of Vt., 27 Atl. Rep. 164.

Assessments for Street Improvements.—Where the statute provides that when the cost of any street work ordered by the city, and chargeable against any lots, shall exceed one-half of their assessed value, the excess shall be paid by the city. Section 7 of the same statute provides the manner of assessment and declares that whenever the said assessment on any lot would exceed one-half of the valuation, then the assessment shall only be one-half. Section 26 provides that, whenever the city council orders any work done, it shall be deemed to have ordered the payment out of its treasury of the excess of any assessment for said work, otherwise chargeable on any lot, over one-half the valuation of the lot. A lot was not limited to an assessment, in a single year, of half its value, but this limitation applied only to an assessment for the work, included in a single resolution. Warren *v.* Postal, Sup. Ct. of California, 33 Pac. Rep. 930.

Validity of Assessments on Abutting Owners for Public Improvements.—A city charter giving power to improve streets at the expense of adjoining property is not unconstitutional, as depriving persons of property without due process of law, because it does not expressly provide for notice to the property owners at any stage of the proceedings. Under a city charter making each lot or part liable in whole or in part for the cost, as the council may determine, of an improvement on the half street, in front thereof, and providing that the council may assess on each lot or part thereof liable for its proportionate share of said cost, it is proper to make an assessment by the front foot. An abutting property owner, with actual knowledge that the work is being done, can not wait till the completion to object to the method of assessment or other irregularities in the action of the city council, which do not affect their jurisdiction. Wilson *v.* City of Salem, Sup. Ct. of Ore., 34 N. E. Rep. 9.

PERSONALS.

Mr. R. F. Fife is a candidate for water-works trustee at Canton, Ohio.

Mr. Alexander Potter has been engaged to design and construct a system of water-works at Kittanning, Pa.

Hoge & White, civil engineers and surveyors, of Wheeling, W. Va., are preparing plans for water-works for Lonaconing, Md., and Benwood and McMechan, W. Va.

Mr. C. F. Loweth, St. Paul, Minn., has prepared estimates for a system of water-works for Hutchinson, Minn.

Mr. George C. Morgan, Chicago, Ill., has been employed by the village board of Galva, Ill., to prepare plans for water-works.

W. S. Shields, C. E., Chicago, Ill., has prepared plans and specifications for the water-works system at Rushville, Ill., and will superintend the construction of it.

Mr. Edward Dillon has resigned the superintendency of sewers in New Haven, Conn., to accept the position of superintendent of the New Haven Water Company.

Two years ago a city in Iowa elected to the office of city engineer a man who had, for six years, worked in the sash factory at $1.25 per day. This year they elected a tailor, who is said to be little better, except that he can speak English.

A new village board was elected at Gouverneur, N. Y., March 6, which is as follows: A. W. Orvis, president; S. W. Payne, James D. Taitt, E. B. Hurlbut, Milton Keech, George H. Robertson and George W. Sellers, trustees. They also constitue the board of water commissioners.

The mayor of Syracuse, N. Y., has appointed Samuel M. Gray, of Providence, R. I., consulting engineer in the work of designing a sewerage system for the outlying sections of the city not covered by the existing plans. A topographical map for the purpose is nearly completed.

The following gentlemen were nominated, March 7, for road commissioners at Stephenson, Mich.: A. C. Stephenson, three years; Mr. Carley, two years; A. F. McGillis, one year. The commissioners are to direct the expenditure of $20,000 which was voted for the improvement of Menominee county roads.

Mr. Alexander Potter has taken into partnership Mr. A. Prescott Folwell, who has for several years been assistant engineer with Capt. Bassett, M. Am. Soc. C. E., and with John Bogart, of New York City. Their offices are at No. 137 Broadway, New York City and Nos. 700 and 701 Lewis Block, Pittsburgh, Pa.

The public work done in Omaha last year under the direction of the city engineer, Mr. Andrew Rosewater, aggregated in cost $843,231.66. Mr. Rosewater's report for the year, as usual, contains much valuable information, liberal quotations from which are made in this number of PAVING AND MUNICIPAL ENGINEERING. Omaha is fortunate in having the benefit of the services of an engineer of such exceptional ability.

LETTERS FOR THE PUBLIC.

WIDE TIRES AND ASPHALT PAVEMENTS.

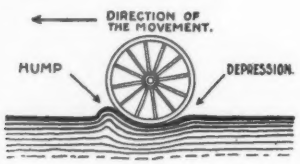
To the Editor of Paving and Municipal Engineering:

Kindly let me say in answer to Mr. Heiskell's article on the "Relation of Wheel Tires to the Paving Problem," that he is probably an engineer, or at least a gentleman, and is therefore entitled to the respect of his opinions; but I was greatly surprised by his article, which, I am sorry to say, does not

agree with the facts here in Philadelphia and in New York. I do not wish to take too much space in your estimable magazine, therefore I will confine myself to a few words about asphalt pavements and wide tires, preferring to send you later some data and figures on this paving question.

Mr. Heiskell seems to believe that asphalt pavement and wide tires are the solution of the problem. I do not think so, and my opinion is based upon long and careful observations.

The city of Philadelphia uses the best asphalt for pavement and many streets are now asphalted. Among them is Broad street, on which run omnibuses which have wide tire wheels. Well, in winter, there is no end of falls among horses caused by the slipperiness of the pavement covered with melting snow; when it rains it is also very slippery, but in summer it is worse. The asphalt pavement gets soft, the wheels sink into it, cause a hump to be formed in front of the wheel and make heavy loads hard to draw on horses. The drivers recognize the fact, and those who have a heavy load prefer block pavement, as it is more easy to start and less dangerous to horses.



If the tire is narrow it will sink a certain amount and creates a hump in front of it; if the tire is wide, the area of the hump will be greater, while the tire will sink less, causing a hump which will be equal in volume to the one formed by narrow tires. Nothing is gained in this direction.

There is in Philadelphia but a very short time when asphalt pavement is superior to blocks. It is in cold, dry weather; at other times asphalt and wide tires for heavy traffic (heavy loads) is a complete failure here.

I have been the involuntary witness of many falls of horses caused by slipperiness, and if this is beneficial to trade or to horses I fail to see how.

However, I agree with Mr. Heiskell that wide tires would greatly aid in maintenance of pavements of all sorts, but that asphalt pavement could be made a heavy traffic pavement I do not recognize. It may be so in the case of brick pavement, but this I confess I have not had any opportunity to find out.

In closing let me say that it would be highly beneficial to Mr. Heiskell to come to Philadelphia during the summer or winter and have a talk with some of the heavy teams drivers.

Emile E. Berthoud, C. E.
Cynwyd, Pa., March 20.

A NOVEL MUNICIPAL ENTERPRISE.

To the Editor of Paving and Municipal Engineering:

The city council of this city passed an ordinance to submit to the electors of the city a proposition to vote $60,000 of five per cent. twenty-year bonds to aid in the construction of a canal for power and irrigation purposes. The work contemplated consists of increasing the capacity of the present canal from 2,000 to 9,000 horse-power, with the necessary head-gates, weirs, etc. The bonds are to be negotiated and sold by the city, and the proceeds to be placed in the city treasury to be paid out on vouchers and estimates approved by the city engineer. The canal company

agrees to furnish to the city of Kearney free of charge, for a period of twenty years, the value of $3,000 in electric lights, or power, and all water needed for flushing sewers and irrigating the public and private grounds within the city for a term of eighty-seven years.

The basis for figuring the value of electric power is to be the rate now charged or that may be charged at Niagara Falls, or the cheapest price for electric power in any of the five largest cities in the United States. The canal company agrees, also, to furnish to manufactories, etc., power at a maximum rate of $20 per horse-power per annum.

An ordinance was passed to submit a proposition to vote $15,000 of five per cent. twenty-year bonds to construct a system of water-works to take water from the canal for flushing sewers and irrigating the public and private grounds within the city.

C. B. Channel, City Eng'r.

Kearney, Neb., March 5.

ECONOMICAL STREET IMPROVEMENTS IN THE WEST.

We have very little rain or snow during the winter season, and with our sandy soil, when our streets are well graded and proper attention given to drainage, there is little need of metal covering, except upon the main thoroughfares, or where there is heavy traffic. Such streets we have improved to the extent of about four miles; adding a few squares, where it seems most needed, each year, in the manner following: The street is graded to a width of thirty feet, with a crown of about twelve inches; then a course of broken limestone is laid along the center, twenty feet wide and six inches thick. The broken stone is then covered with six inches of gravel, allowing the same to lap over the stone about two feet on each side.

Strange as it may appear to you who are floundering in the mud half the year whenever you get off your paved streets, this makes a very economical and durable improvement for the streets of our western cities where the traffic is not too heavy.

Our streets are in a very satisfactory condition, but what our city now most needs is a sewerage system. Though we have a plan for a complete system of sewerage for the entire city on file in the city clerk's office, the authorities have not seen fit to do anything in that line as yet. We hope to make a beginning next season. *J. S. Boynton.*

Winfield, Kansas.

SANITARY SEWERS IN FREEPORT, ILLINOIS.

To the Editor of Paving and Municipal Engineering:

We have just finished a complete system of sanitary sewers, reaching every lot within its limits. It is one of the most, if not the most extensive system of sewers that any city of this size has yet built.

Besides three or four lines previously built, the new system contains:

90,617	lineal	feet	of	8	inch	sewers.
4,974	"	"	"	10	"	"
4,582	"	"	"	12	"	"
8,624	"	"	"	15	"	"
6,081	"	"	"	18	"	"
472	"	"	"	24	"	"

Total, 115,349 feet, or almost 22 miles.

There are 184 man-holes and 173 lamp holes. The depth is intended to be from nine to ten feet, but of course in order to reach every part of the city many places are deeper—some as deep as twenty and even twenty-two feet. In many places we had to fight deep and extensive pockets of quicksand. The cost, however, including court cost, as-

sessment and superintendency, will not exceed 80 cents per lineal foot, or 40 cents for each foot of frontage. So, it will be seen, we have made an extensive use of 8-inch pipes. This was made possible by the topography of the city; for instance, some lines of that dimension are so located that as they go down and collect other lateral branches they keep increasing in grade to three or five and even more in 100.

For the same reason the flush tank has been omitted, although few lines might need it. It has been deemed more advisable and economical for the present to provide the sewer department with hose and flush them when needed.

Arthur Lagron, City Engineer.
Freeport, Ill.

QUESTIONS OF VITAL IMPORTANCE.

To the Editor of Paving and Municipal Engineering:

You have a new and vast field of public usefulness and as a specialty in your line of thought and improvement, I do not think that you have a competitor. Your magazine can legitimately cover the whole ground of sanitary and economic questions as a specialty, and if edited with due care and ability, can not fail to meet the wants and liberal patronage of our intelligent and progressive citizens.

The building of our future cities, the improvement of our present cities, the building of country highway roads, the improvement of our rivers and harbors, the building of canals, inter-ocean and coast line inland, are all questions of such vital importance that they need more than mere newspaper attention, or perfunctory action of our public civil engineers.

I have no space here to point out faults in all these things, or to propose remedies, but I will say that our law-makers, our modern city projectors and builders, our civil engineers, our architects and our real estate owners and improvers are far behind our inventors and improvers in all that makes our country great, rich and progressive. *J. W. Crary, Sr.*
Bluff Springs, Fla., March 8, 1894.

MEETINGS OF CIVIL ENGINEERS.

Engineering Association of the South.—The regular monthly meeting was held at headquarters in the Cumberland Publishing House, on Thursday evening, March 8, Vice-president Smith presiding.

Messrs. A. P. Gaines, Cowan, Tenn.; I. O. Walker, Paris, Tenn., and C. P. Perrin, Pikeville, Tenn., were elected to membership. Action of the board of directors, advancing Mr. Alfred Hume from junior to membership was reported.

The paper of the evening was read by the secretary in the absence of the author. It was entitled "Coal Handling Plant at Pikeville, Tenn.," of which the following is a synopsis: "Owing to increasing competition among coal mines and consequent demand for better product, old simple forms of chutes are now being superseded by those in which the coal is thoroughly cleaned and tenderly handled. The mine cars are carried to and from tipple by self-acting creeper chain. Coal is dumped on back tippler, eliminating a large amount of breakage of coal usual in the old style tippler. Lump is made over shaking screens, 1½-in. perforations; inclination 1½ in 12. The coal is lowered gently into cars by a specially designed chute, having had nowhere a direct drop of more than a few inches. Nut and slack are elevated together and separated on shaking screens, ½-in. perforations; inclination 3¼ in

12. Good results are obtained from corrugating these screens. The uniformly sized slack made by this plant greatly improves the physical properties of coke. The use of perforated metal shaking screens, compared with that of bar screens, increases both quantity and quality of salable coal. Capacity, 1,000 tons per day; cost, $4,400.00; estimated running expenses, $6.00 per day. The plant was designed and erected by the author, Mr. J. J. Ormsbee, Supt. Sequatchie Valley Coal and Coke Co.

Hunter McDonald, Sec'y.

Nashville, Tenn., March 12.

Civil Engineers' Society of St. Paul.—Mr. C. J. A. Morris informally addressed the meeting on the subject of "Coal Docks and Coal Handling Plants." He illustrated his theme by maps, plans, photographs, etc., of the belt railway and coal dock of the Northwestern Coal Railway Co., now building at Superior, and of various excavating, conveying and coal handling devices. The belt line is projected to intersect all railroad lines entering Duluth and Superior, of which there are at present six. The dock will be formed by filling to an average depth of ten feet a tract of more than seventy-five acres, to be bounded by cribs of 12-in.x12-in. timber, hemmed in by a row of 60-ft. piles, driven to 4-ft. centers. The cribs are 22 ft. deep, 24 feet wide, and are sunk in 250-ft. sections with material (principally sand) raised by a hydraulic dredge, capable of moving at least 300 cu. yds. of solid matter per hour. The dredge consists of two scows of 5½-ft. draft, connected by a hinge joint. The end of the 20-in. suction pipe, carrying a revolving cutter which masticates anything in its way except solid rock, ranges vertically 28 ft. and horizontally 80 ft. by the swinging of the smaller scow, the main boat (95 ft. long) being anchored by fore and aft spuds. If the dredge is swung from the forward spud a range of 150 feet is secured. A 400 horse-power engine works the pump (centrifugal) and cutter. Material may be economically carried through the 18-in. delivery pipe 3,500 ft. The plan of handling the coal on the ample dock has not been definitely fixed.

C. L. Annan, Sec'y.

St. Paul, March 5.

Association of Engineers of Virginia.—A monthly meeting for informal discussion was held February 28th, 1894, with the president, Mr. C. S. Churchill, in the chair. The subject for the evening was, "Bridging the Hudson and East Rivers at New York City," opened by Mr. C. C. Wentworth.

Mr. Wentworth stated that owing to his not being able to obtain definite information in regard to the subject, he would talk, instead, about highway bridges. He then gave a very interesting description of how, by tabulating his work, he was able to get up the estimates, and also get the working drawings into the shops very quickly, saving both time and money. Complete tables were exhibited, giving weights of trusses of various forms for given lengths and panel loads, of floor beams for given widths, panel lengths and floor loads, and of bracing for given spans and widths, by means of which an accurate estimate of the iron work in a given structure could be obtained; also strain sheet blanks, giving for the various forms of trusses the strain on each member by simple multiplication by the assumed dead and live load per panel; and tables of

section from which the approximate section for each chord, post or tie can be chosen when the strain is determined. Standard shop drawings were also exhibited, showing eye bars, chord members, and posts of different sizes in which only a few blank dimensions have to be filled in to adapt them to any given length.

The subject was discussed by Messrs. I. Henderson, Yeatman and others, Messrs. Henderson and Yeatman giving illustrations of where they had used the tabulated information to a great advantage.

Mr. Coleman gave a verbal report from the "State Road Law Committee," showing that even while the bill did not pass the legislature it had been well considered and would probably be brought up again.

The following standing committees for the year (1894) were announced:

Finance and Membership—J. C. Rawn, M. E. Yeatman, H. A. Gillis.

Publication and Entertainment—R. H. Soule, G. R. Henderson, Clarence Coleman.

House and Library—Wm. M. Dunlap, W. W. Coe, Jno. Graham, Jr., Geo. P. Wood.

Jno. A. Pilcher, Sec'y.

MACHINERY AND TRADE.

RECENT INVENTIONS.

Cut-off Table for Brick Machines, No. 515,383, Wm. W. Wallace and Raymond C. Penfield, Willoughby, O., consists of a supporting frame, a horizontally recriprocating frame suitably mounted upon the supporting frame, said horizontally moving frame having a table for receiving the bar or column of clay to be severed into pieces and being adapted to receive an off-bearing board or pallet forward of said table, the supporting frame being provided with a stationary back arranged in a plane above and lengthwise of the table, and adapted to engage the severed pieces of clay and force the same from the table onto the off-bearing board or pallet during the rearward movement of the table-bearing frame, and a severing wire frame pivotally connected with the table bearing frame and adapted to tilt rearwardly and downwardly.

Transportable Metallic Bridge, No. 515,445, Francis Prasil, Prague, Austria-Hungary, is a structure comprising sections having tubular ends, with the girders perforated and fitting between the same and coupling passing through the girder and connecting the tubular ends.

Ditching Machine, No. 515,678. Wm. L. Harvey, Stanberry, Mo., consists of a scraper arranged on the side of a platform car, and connected at its ends with draft beams secured on the platform car, transverse levers, pivotally connected with the scraper, blocks capable of a free transverse movement on bearings on the car, and connected with the said levers so as to form a fulcrum that will slide on the said bearings when the levers are swung up or down, and a hoisting device connected with said levers.

Road Scraping Machine, No. 515,679, John H. Hawkins, Grabeel, Mo., consists of a frame having depending hangers, between which is pivotally secured the rear end of a

scoop or scraper, means for connecting the forward portion of the scraper with the lever having forwardly projecting members.

Brick Machine, No. 516,023, Nathaniel B. Rice, Chicago, Ill., consists of the combination of two wheels having around their peripheries a series of molds and intermediate plain faces, suitable scrapers for said mold wheels, and two presser wheels of smaller diameter than the mold wheel, said presser wheels having abruptly curved raised ribs across their peripheries to impart flat faces to the clay within the molds, and fixed bearings for said presser wheels.

Brick or Tile Cutting Table, No. 515,934, John D. Fate, Plymouth, Ohio.

Wheeled Scraper, No. 515,982, John R. Williams, Kansas City, Mo., consists of an axle and wheels mounted on said axle, a pair of bars having a platform and detachably mounted upon said axle, a lever pivotally carried by said bars, and pivotally carrying an open ended scraper-box or pan, and a gate pivotally connected to said box or pan, and having hooked or flanged upper ends engaging said lever, and means to lock said lever in its depressed position.

Road Scraper, No. 515,999, Wm. H. Deidrick, Stockton, Cal., assignor to John D. McDougald, same place, consists of the combination with a scraper bowl of suitable runners flexibly and adjustably attached thereto, suitable means for operating such runners, suitable draft rods, a suitable stop rod and lever for operating such scraper.

Lock and Dumping Mechanism for Wheeled Scrapers, No. 516,044, Alfred F. Bernard, San Luis Obispo, Cal., consists of the combination with the wheels and the body of an oscillating brake rod mounted on the body and having shoes on its ends adapted to bear upon the wheels, an operating lever fulcrumed upon the body, a crank lever secured to and depending from the brake rod, and a link connecting said crank lever with the operating lever.

Bridge Gate, No. 516,121, Geo. F. Ryan, Chicago, Ill., assignor of one-half to Joseph L. Duplissis, same place, consists of the combination with a gate and a drawbridge, of a mechanism for transmitting motion from the bridge to the gate, said mechanism including a vertically movable gear wheel which receives motion from the bridge, and means for removing said wheel vertically.

V. H. Lockwood, Pat. Solicitor.
Indianapolis, March 20.

THE BUCYRUS STEAM TUNNEL DRYER.

A very handsomely printed brochure devoted to the Bucyrus Dryer has just been issued by the Frey-Sheckler Company of Bucyrus, O. They claim for the dryer, that it will remove more moisture with less fuel than any other. "The operator has perfect control of the heat in each tunnel; can maintain low heat in one and high in another; can empty one tunnel without interfering with or admitting cold air into the others; can use one tunnel, many or all tunnels as desired; instead of feeding circulation by the admission of cold moist air from the exterior, the hot dry air is drawn from the attic of the dryer, thereby hastening drying and saving fuel."

The building is constructed of brick, the exterior walls being eight inches thick; the interior walls four inches thick. The height

of the walls is determined by the size and character of the product to be dried. Directly above the walls are placed two thicknesses of one-inch boards, lap-jointed, closely laid, and over this is placed twelve inches of common earth for the purpose of retaining the heat within the tunnels. The weather roof may be constructed of tar, pitch and gravel, iron, shingles, or any other material that will shed water. At proper intervals in the walls are placed the warm air-ducts, which are used for conveying the warm air from the space above earth-filling and underneath roof, where the air is both warm and quite free from moisture both summer and winter. These ducts are arranged so as to discharge the warm air directly underneath the steam radiating pipes, which are constantly supplied with steam at a high pressure. The air coming in contact with the radiators, and, becoming highly heated, rises up through and between the brick or other clay goods, gathering moisture from the same in its ascent, thence passes out through vapor stacks directly into the outer atmosphere. In each of the vapor stacks is placed a damper for regulating the draft and creating a thorough circulation among the brick.

The heating system is composed of one-inch pipes, extending the entire length of the tunnels, and connected at each end with double-headers. These pipes are arranged in four longitudinal series—one on each side of the tunnel, placed parallel with the cars of brick, and two series directly underneath the track, between the rails—in the best possible position for conveying heat to drive off the moisture from the brick on the cars. As will be fully understood, every pipe in each of the sections of radiators is perfectly accessible at all times for observation or repair, without disturbing any other section or pipe, and without getting underneath track, close to a nest of hot pipe. This point will be thoroughly appreciated by any one at all conversant with radiators. Each of the radiating sections is supplied with separate and independent drip-pipes for carrying off the product of condensation, which is forced by pressure to a receiving tank placed adjacent to the boilers, from which tank it flows by gravity to a steam pump, thence forced into boilers still at nearly boiling heat, thereby saving fuel, and at the same time furnishing strictly pure water.

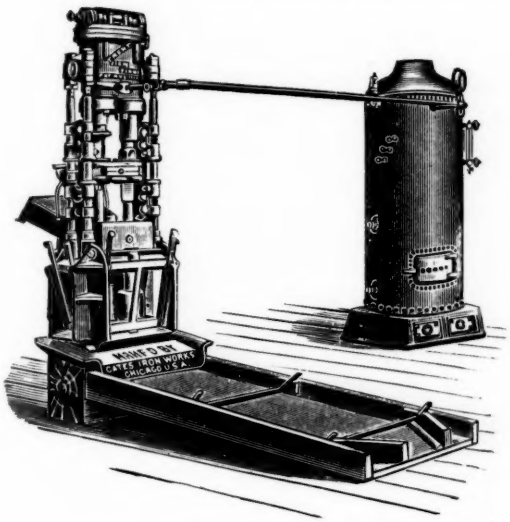
Each tunnel is supplied with its own valves, so that it is perfectly under the control of the operator, whereby each tunnel can be worked independently or in connection with the others.

The Frey-Sheckler Company claim for their system that it is the most practical and economical method of converting fuel into hot air, for the drying of brick made by either the stiff-mud, soft-mud or dry-press processes; likewise hollow blocks fire-proofing and porous terra-cotta. A large volume of air, heated by steam radiators, is recognized by the highest authorities as being the best known medium of extracting moisture from clay, and this has been demonstrated by the Bucyrus Steam Tunnel Dryer. [The Frey-Sheckler Company, Bucyrus, Ohio.]

A PRACTICAL STEAM STAMP.

Among all the mining machines and appliances shown at the World's Columbian Exposition there was probably nothing which elicited more interest and favorable comment than the Tremain Steam

Stamp Mill in the Mining Building. It was a positive novelty to the great majority of mining men. It commanded attention by reason of its simplicity and evident practicability. Experienced mining engineers were astonished to learn that such a machine had been in successful operation for over two years in the extreme north-western part of the United States. It was the apparent usefulness of this machine that led the Gates Iron Works, of Chicago, to negotiate for the rights of manufacturing it. A practical stamp mill equal to an ordinary five stamp mill that can be introduced in a mining camp and put in operation at one-half the cost of any class of machinery hitherto employed for the same purpose is certainly worthy of close investigation.



As to efficiency, the plant furnished by the Gates Iron Works for a few hundred dollars will do the work of an ordinary plant costing as many thousand. The work the machine is intended to do is to crush to fine powder the gold or metal-bearing quartz or rock, so that the minerals can be easily collected by concentration and amalgamation.

They use two stamps, each of which has a stamp stem. The weight with piston, piston rod and other attachments is about 300lbs. each. The steam is taken from the boiler and admitted to the under side of the piston, which raises the stamp. When it has reached the top of its stroke, by an ingenious device, the steam which has already been used to lift a stamp is now conveyed to the top side of the piston, which has a much larger area than the under side, and a blow is struck by the weight of the stamp urged by the steam pressure, of 1,000 pounds under ordinary boiler pressure. This is the amount of force developed, the amount expended being that which is required in lifting the stamps six inches. It is as if 1,000 pounds weight were constantly lifted free of cost. This is of great importance and is one of the great advantages of the system. The steam is made to do the work directly and without lifting heavy, cumbersome blocks of iron, and the result is the saving of three-fourths of the cost of fuel.

The mill is substantially shown in the cut accompanying this. Its height is 7 feet 6½ inches, its base is 18x22 inches. Its screens consist of one 14x18 inches and two 14x7 inches. The weight of the complete mill with feeder is about 2,700 lbs.

The Gates Iron Works is now prepared to furnish these stamp mills on short notice. One week, under ordinary circumstances, is sufficient time to fill an order.

PLUNGER BRICK MACHINERY.

Another new catalogue, issued by J. W. Penfield & Son, of Willoughby, Ohio, is devoted to their plunger brick machinery. They have

these machines in six sizes, with a daily capacity ranging from 6,000 to 80,000 end-cut or side-cut brick. They are used for making a variety of clay products in addition to the manufacture of common building brick. A number of leading establishments use them in making paving brick. They also successfully produce blanks for roofing tile, clay shingles, terra-cotta lumber, hollow building blocks, foundation and cellar blocks, and they are unexcelled for the manufacture of drain tile, face and ornamental brick. They are constructed in a strong and substantial manner throughout. The gearing is extra heavy and strong. The main shafts are of forged steel, being hexagon in shape where the knives fit on, holding the knives in position without keying or set-screwing. The cam, friction rollers and plunger head and beveled pinions are of steel. The tub is of heavy boiler plate. The plunger head is provided with an adjustable scraper or wing to compensate for wear. The operation of the machine is thus described:

"The clay before going to the brick machine should be thoroughly and evenly tempered, and of such consistency that the brick made from it can be hacked direct from the machine. The clay is fed into the tempering cylinder, in the center of which is a shaft filled with blades which mix the clay and force it through a porthole into the pressing chamber. The plunger presses the clay through the die and upon the cut-off table.

"The plunger is propelled by a steel cam on the main shaft, between the upper and lower bed plates. The cam works upon rol lers at both ends of the sliding plunger frame, giving alternately a backward and forward motion at each revolution of the shaft. The machines are made either single or double workers, one cam doing the work in either case.

"As soon as the bar of clay comes to rest on the cut-off table, the operator pulls the wire strung cutter frame forward and downward, forcing the wires through the bar of clay and separating it into brick. The brick are then removed (by means of forks or clamps or small boards held in each hand) and placed upon barrows or dry cars, preparatory to conveying to the drying department. The cutter is not thrown back until the brick are lifted from the cut-off table. Side-cut brick are usually made with two holes in them, so that they can be lifted, four at a time, by means of forks." [J. W. Penfield & Son, Willoughby, Ohio.]

Mr. W. H. Pfrimmer, of Columbiana, Ohio, is engaged in making a steam roller for the Enterprise Manufacturing Co. which will probably be on the market in the course of sixty days.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Five million brick will be used for street paving purposes in Quincy, Ill., this year.

Streator, Ill., will expend $90,000 in paving and other street improvements this year.

The macadamized road through the stock-yards at St. Joseph, Mo., has been opened to the public by a decree of the county court.

Vitrified brick for street paving is very much favored in Evansville, Ind. During the past three years about thirteen miles of brick paving have been constructed.

Springfield, Ohio, has five miles of streets paved with stone and brick. By means of a road roller, during the past season, nearly all of the unpaved streets were improved to the extent of almost equalling macadamized streets.

The city engineer at Leavenworth, Kan. estimates the cost of paving Delaware street, from Main to Sixth, with vitrified brick, at $9,357.60. The expense will be divided as follows: City, $1,624.80; railroad company, $2,283.20; property owners, $5,449.69.

The Bermudez Asphalt Company has been incorporated in Indianapolis, with a capital stock of $24,000. This organization is a branch of the New York and Bermudez Company of New York City. It was formed for the purpose of introducing in Indianapolis this company's brand of asphalt. The incorporators are; A. W. Conduitt, J. W. Cooper and Lee Fulmer.

The paving of Bellevue place, the section of Sixth street which connects Pearl street with Fremont avenue, is completed. It is an asphaltum pavement on a six-inch concrete base. As a very large amount of water runs through this street especial care was exercised in the construction of the gutter, which is of granite blocks, and the interstices between the blocks are filled with liquid asphaltum instead of cement. The work gives much satisfaction.

CONTEMPLATED WORK.

Street paving is contemplated in York, Pa.

Olney, Ill., contemplates some street paving this year.

Clifford avenue, Indianapolis Ind., will be paved with asphalt.

Stephenson street, Freeport, Ill., will be paved. Brick is favored.

Junction avenue, Racine, Wis., will be paved during the summer.

The residents of Downer Place, Aurora, Ill., want that street paved this year.

The paving of East Seventh avenue, Monmouth, Ill., is being considered.

North Adams, North Jefferson, and possibly Main street, Peoria, Ill., will be paved.

The city of Rushville, Ind., contemplates paving some of its streets with brick.

An asphaltic pavement has been ordered constructed on 28th street, Georgetown, D. C.

The city council at Lima, Ohio, contemplates paving the public square and Main street.

A movement has been made at Scranton, Pa., to pave Ninth, Robinson and Jackson streets.

The property owners on Euclid avenue, Toledo, Ohio, want an asphaltic pavement constructed.

The village council at St. Bernard, Ohio, has passed resolutions to improve Catherine street and Ludlow avenue.

The city council at Zanesville, Ohio, has declared it necessary to pave Putnam avenue with vitrified paving brick.

The city council of Cincinnati, Ohio, has voted $200,000 for the purpose of paving Spring Grove avenue with brick.

An expenditure of $100,000 is contemplated in Evansville, Ind., this year, for paving several streets with vitrified brick.

The board of public affairs at Springfield, Ohio, contemplates improving several miles of streets with macadam paving.

The board of administration, Cincinnati, Ohio, deems it necessary to pave with brick, granite and bowlders sundry streets and alleys.

Paving will be vigorously pushed forward in Cleveland, Ohio, this year. A large number of streets will be paved and repaired.

West Otterman street, from Division street to the borough limits, Ludwick, Pa., will be paved. West Pittsbugh street will be widened.

There is a movement to pave Commercial street, Seattle, Wash.

L. E. Browne, Richmond, Ind., writes that the city contemplates grading and macadamizing several streets and the construction of a few sidewalks.

The secretary of the borough council of Quakertown, Pa., has been authorized to prepare an ordinance ordering the paving and curbing of Ambler street.

The question of paving Raymond and Fair Oaks avenue, Pasadena, Cal., is again being agitated. The present outlook is that it will be done this summer.

An asphaltic pavement is contemplated in Scio street, Rochester, N.Y., with Medina stone curbings. Medina stone pavements will be constructed in South avenue and State street.

The state board of Hartford, Conn., has appointed Commissioner James U. Taintor to confer with property owners on Main street regarding the construction of a pavement thereon.

The property owners on Fourteenth St., in Davenport, Iowa, are again urgently petitioning the paving of that thoroughfare. Grand avenue residents also ask for the paving of that street.

Plans and specifications are being prepared for the construction of a Telford road extending from Westville, N. J., to Paulsboro. The estimated cost of a road nine feet wide is $4,500.

Eugene Kirk, Youngstown, Ohio, writes that the city council passed a resolution favoring the repaving of East Federal street between the east line of Central square and Watt street.

Wayne street in Sandusky, Ohio, is to be paved. The city council favors an asphaltic pavement, while the property owners demand brick. The council also declares it necessary to pave Market street.

The members of the common council at Binghamton, N. Y., are urging that asphaltic pavements be constructed in a number of streets this year. Among the streets named are Chenango, Collier and Front streets.

The public works committee at Pittsburgh, Pa., recently recommended a large number of ordinances providing for grading, paving and repaving. The property owners of Arch street have petitioned for the repaving of that thoroughfare.

A committee has been appointed in Chicago, Ill., to secure the signatures of property owners along Lake street, Central Park, who favor paving that thoroughfare with shale brick. The committee consists of Messrs. Will Newman, C. T. Duhamell and Otto Von Bruch.

A petition has been made to councils at Allegheny, Pa., by the property-holders abutting on Montgomery avenue, for the paving of that thoroughfare this year.

A petition has been circulated at Evanston, Ill., for an asphaltic pavement on Davis street, utilizing the macadam which is in the street at present for a foundation.

The Board of Public Works, Indianapolis, Ind., has adopted resolutions for asphaltic paving on New Jersey street, from Washington to the south-western property line on Massachusetts avenue; New Jersey street, from Massachusetts avenue to Fort Wayne avenue; for paving with brick, sundry streets and alleys.

Fredonia, N. Y., will have paved streets, the result of an election held in that village, March 12, when the "Young Men's Improvement" party elected their full ticket, as follows: President, E. H. Pratt; trustees, O. W. Fargo and Charles D. Thayer; collector, Joseph F. Wilson. Many other needed improvements will also be made in the village.

O. R. Rauchfuss, city engineer at Joliet, Ill., writes that ordinances have passed for paving Cass street, 42 by 5,200 feet, and ordinances are ordered for brick paving on Eastern avenue 6,800 feet, and Richards street. The pavement will be single brick on four inch concrete foundation, the contract for paving Richard street with cedar block has been annulled on account of a legal error.

CONTRACTS TO BE LET.

J. H. Farley, director of public works, Cleveland, Ohio, invites bids until April 4, 1894, for paving sundry streets.

Bids will soon be asked at Jersey City, N. J., for repaving, with asphalt, five streets. George T. Bouton, clerk.

Bids are invited at Franklin, Ind., until April 10, for grading and graveling with stone Yandes street. W. D. Greene, city clerk.

Eugene Kirk, Youngstown, Ohio, writes that the contract for laying stone sidewalks for the ensuing year will be let April 13, 1894.

Sealed proposals will be received until April 9, 1894, Steubenville, Ohio, for macadamizing West Market street. Sam Houston, engineer.

Bids will soon be invited at Jerseyville, Ill., for paving with brick three blocks of Main street and three blocks of Pearl street. Wm. Embley, city engineer.

Bids will be received until April 10, at Fort Wayne, Ind., for constructing an asphaltic pavement on Washington street and for paving with brick sundry sidewalks.

Sealed proposals will be received at the office of J. M. Harper, Ninth and Plum streets, Cincinnati, Ohio, until April 3, 1894, for macadamizing Auten avenue, Pleasant Ridge, Ohio.

Sealed proposals will be received at Delphi, Ind., until April 6, 1894, for the improvement of concrete sidewalks, twelve feet in width, in a number of streets. C. A. O'Brien, city clerk.

Sealed proposals will be received by the board of commissioners of Lucas county, Ohio, until April 10, for grading and macadamizing Cedar Point road. Charles H. Jones, Toledo, Ohio.

Contracts will be awarded April 7, 1894, at the office of the board of Hamilton county commissioners, Cincinnati, Ohio, for the improvement of the Carthage pike. Fred Bader, president.

Sealed bids will be received by the city clerk, Sam C. Rickson, at Joliet, Ill., until April 16, for paving with brick Center street, from De Kalb street to Western avenue, about 2,500 feet in length.

John G. Overman, clerk, Ludlow Grove P. O., Hamilton county, O., will receive bids until April 5, 1894, for macadamizing Washington avenue, St. Bernard, O., from Carthage pike to Beecher avenue.

H. C. Shultz, city clerk at Waterloo, Ia., invites bids until April 7, for paving with brick and curbing with stone, sundry streets; approximate number of yards 13,500; approximate number of feet curbing, 4,600 lineal feet.

Bids are invited until April 4, 1894, by the board of administration, Cincinnati, O., for an asphaltic pavement on Vine street, extending from 100 feet north of St. Clair street to the Zoological Garden. A. P. Butterfield, clerk.

Bids are invited at Avondale, Ohio, until April 4, 1894, for the improvement of Wilson avenue, from Rockdale avenue to Ehrman avenue. Plans and specifications on file in the office of the village engineer. W. Ellwood Wynne, corporation clerk.

Sealed proposals will be received at Omaha, Neb., until April 16, for paving or macadamizing the public highways of Douglas county. Class of paving material for which bids will be received are as follows: Sioux Falls granite, Colorado sandstone, brick, sheet asphaltum, macadam. Fred J. Sackett, county clerk.

Bids are invited until April 9, 1894, Fostoria, Ohio, for paving with vitrified brick Perry street, the paving to be laid on a crushed stone and sand foundation, with sand filling; bids will also be received for paving Union street with vitrified paving brick, on a crushed stone foundation with sand filling. J. P. Force, city engineer.

Sealed proposals will be received at the office of H. J. Caren, Columbus, Ohio, until April 25, 1894, for the improvement of 2,000 feet of the Gahanna Cemetery road.

G. L. McKibben, city engineer at Van Wert, Ohio, writes that bids will be asked, probably about April 25, 1894, for paving with brick and curbing four streets and macadamizing two. The work will include about 30,000 square yards of brick paving and 15,000 lineal feet of curbing. The plans and specifications were prepared by Mr. McKibben.

Bids will be received at the office of the board of administration, Cincinnati, O., until April 3, 1894, for the following: paving with brick, Woodward street, from Maine to Hunt street; paving with granite blocks, Vine street, from Moliter street to a point 100 feet north of St. Clair street. A. P. Butterfield, clerk of board of administration.

The contract for an asphaltic pavement on Wisconsin street, Milwaukee, Wis., will be awarded in time, if possible, for the work of construction to begin about May 1, 1894. An effort is being made to secure action of the common council on the proposed asphaltic pavement on Grand avenue, in order that the work may be carried on at the same time.

CONTRACTS AWARDED.

Mr. Otto E. C. Guelich, who has the contract for paving North Woodward avenue, Detroit, Mich., will begin paving April 15.

The Winona Construction Company, Winona, Minn., was awarded the contract for 80,000 yards of street paving at Quincy, Ill.

The city council at Streator, Ill., awarded to Fawcett Plumb the contract for paving 36,000 square yards of streets at $1.29 per square yard.

The contract for paving Cortland avenue, Syracuse, N. Y., with brick, was awarded to Paul T. Brady, of that city. The contract price is $48,385.50.

The contract for an asphaltic pavement in Wilson avenue, from Livingston avenue to Schiller street, Columbus, O., was awarded to A. G. Pugh & Company.

George H. McEwen secured the contract for grading and macadamizing the alley between Fifth and Sixth streets and Shelby and Sevier streets, Nashville, Tenn.

The Warren-Scharf Asphalt Company was awarded the contract for paving with asphalt Chesapeake street, from Pennsylvania to Delaware street, Indianapolis, Ind.

The Southern Construction Company, of Chattanooga, Tenn., was awarded the contract for 69,055 square yards of brick pavements in Jacksonville, Fla., for $1.47½ per square yard.

F. F. Rogers, city engineer at Port Huron, Mich., writes that bids were received March 29 on 16,000 square yards of cedar block paving laid on one-inch pine boards. Medina stone curbing will be used.

The contract for a cedar block pavement in North avenue, from the Milwaukee river to Third street, Milwaukee, Wis., was awarded to Peter J. Herbold, at $1.05 per square yard, and 55 cents per lineal foot for curbing.

The contract for paving Arlington and East Exchange streets, in Akron, Ohio, was awarded to Daniel O'Marr. James Wilde secured the contract for paving West Exchange street. The improvement will aggregate about $120,000.

The department of highways, Easton, Pa., recently recommended that the contract for paving Northampton street be awarded to Miles & Son; Washington street to W. F. Pascoe. McMahan-Porter brick was also recommended for use.

The Washington Asphalt Block Tile Company, Washington, D. C., secured the contract for the asphaltic pavements to be constructed in Jacksonville, Fla. P. Maloney, president of the company, agreed to lay four inch asphalt blocks for $2.20; five inch blocks for 25 cents more per square yard.

The contract for macadamizing Blue avenue, Kansas City, Mo., was awarded to W. C. Rice for thirty-four and seven-eighth cents per yard. Blue avenue is a continuation of Fifteenth street, and the contract includes three miles of paving, which will, when completed, give a continuous macadam road from Kansas City to Independence.

Contracts have been let in Syracuse, N. Y., as follows: James street, 26,500 square yards Trinidad sheet asphalt to Trinidad Asphalt Refining Company, for $86,034; Cortland avenue, 14,950 square yards vitrified brick pavement, Hallwood block, manufactured at Nelsonville, Ohio, to Paul T. Brady, of Syracuse, N. Y., for $48,385.50; Davis street, 5,400 square yards Trinidad sheet asphalt, to Syracuse Improvement Company, for $17,246.80.

Mr. H. P. Langworthy, Kansas City, Mo., writes that on March 5, contracts were awarded for paving parts of a number of streets, as follows: Brick paving awarded to F. P. McCormick, Brooklyn avenue, $3,962.64; Fourth street, $1,463.08; Third street, $4,202.80; Fifteenth street, $3,615.68; Vine street, $2,180.85. Kansas City Building and Construction Co., Walnut street, $561.92. Granite paving, James O'Donnell, Walnut street, $4,061.17. Asphaltic paving, Barber Asphalt Paving Co., Eleventh street, $9,752.50; Fourth street, $4,171.37; Grand avenue, $29,586.72; Holmes street, $13,467.50; Walnut street, $21,184.80.

SEWERAGE.

The outfall sewer at Los Angeles, Cal., was tested March 1, and pronounced a success.

The sanitary and storm sewers under course of construction in Fort Dodge, Ia., is said to be one of the most important improvements ever undertaken in that city.

Work has begun at Quincy, Ill., on the sewer which will extend from Seventeenth and Hampshire streets east to Eighteenth street, thence south to Maine street, thence east to a point near Twenty-fifth street.

The large sewer between Fifth street and the river, St. Paul, Minn., known as the Canal street and Phalen creek sewer, is completed. The cost is about $50,000 and it is pronounced one of the most important undertakings in the sewer system of that city.

F. F. Rogers, city engineer at Port Huron, Mich., writes that the sewers in the Third ward, for which bids were received March 29, aggregate 5,183 feet. They are as follows: Five hundred and eighteen feet 20-inch pipe; 255 feet 12 inch pipe; 1,700 feet of 10-inch pipe and 2,710 feet 8-inch pipe. These sewers are designed on the combined plan and will handle one-half inch of rainfall per minute. Bids were also received on a stone culvert over McNeil creek on Gratiot avenue. Estimated cost of culvert, $472.

CONTEMPLATED WORK.

A sewerage system is contemplated at Vicksburg, Miss.

A new sewer ordinance is being discussed for Belleville, Ill.

A system of sewers is contemplated at Morgantown, W. Va.

A system of sewerage is seriously contemplated at Pomona, Cal.

An improvement in the sewerage system of Athens, Ohio, is being urged.

A sewerage system for Woodbury, N. J., is being agitated by the city officials.

About eleven miles of sewers will be constructed at Perry, Ia., this summer.

A sewer has been petitioned for on East Portage avenue at Sault Ste. Marie, Mich.

The citizens of Hamburg, N. Y., are contemplating the construction of a trunk sewer.

A grand trunk line sewer is contemplated which will extend from Champaign to Urbana, Ill.

J. Alcide Chaussé writes that owing to the recent flood at Brantford, Ont., the outflow pipe of the sewerage system will have to be extended 1,000 feet further down the river.

The city council of Sandusky, Ohio, declares it necessary to construct a sewer in Shelby street.

A sewer is to be built from East Orange, N. J., to the Passaic river, at a cost of about $240,000.

The construction of several miles of lateral sewers this year is contemplated at Meriden, Conn.

Union Hill, N. Y., contemplates an expenditure of $200,000 for a perfect system of sewerage this year.

Petitions for sewers in Bridgeton, Pa., this spring had signers representing over $1,000,000 of property.

The village of Olyphant, Pa., contemplates the construction of sewers. Address C. G. Hitchler, burgess.

It is thought that a new system of sewerage will be recommended for Reading, Pa., by the city council.

An extension of the outlet sewer into the bayou, three miles from the city, is contemplated at Houston, Tex.

Eugene Kirk writes that the city of Youngstown, Ohio, contemplates building a number of sewers this season.

The board of public works at Detroit, Mich., will expend about $150,000 in the construction of sewers this year.

The property owners in the Sixth ward, at Rock Island, Ill., are agitating the question of a system of sewerage.

An ordinance has been approved in Marquette, Mich., providing for a sewer in Ohio street. Thomas Meads, recorder.

The board of public affairs at Springfield, Ohio, is contemplating the construction of an immense intercepting sewer.

William A. Johnston, Barberton, Ohio, is preparing plans and specifications for a contemplated system of sewers for that city.

An ordinance declaring it necessary to construct a sewer in Jackson street was passed by the city council at Defiance, Ohio.

The sewerage system at White Plains, N. Y., is to be extended to Dusenbury Hill, a suburb. Address F. M. Thompson, town clerk.

Frank J. Hogland, city clerk at Rockford, Ill., writes that the city has in contemplation the construction of sewers to the extent of $17,000.

The commissioners at Washington, D. C., have ordered a sewer to be constructed in the west side of third street between P and Q streets. This sewer will be added to the schedule of sewers that will be built during 1895.

A system of sewers is being contemplated by the village authorities at Penn Yan, N. Y. Estimated cost, $30,000. Address W. D. Dwelle, village clerk.

The city council at Columbus, Ohio, authorized, February 26, a loan of $46,000 for the construction of sewers in the sub-district Q, main district Q.

Ordinances appropriating $939,000 for the construction of sewers have been favorably reported by the sub-committee on main sewers, Philadelphia, Pa.

The mayor and common council at Wausau, Wis., have passed a resolution providing for the construction of a sewer in Seventh street. R. E. Parcher, mayor.

Melrose, Mass., voted to petition the legislature for authority to issue $100,000 bonds bearing interest at four per cent., for the purpose of constructing a sewer system.

Further action has been taken towards the contemplated sewerage system at Woonsocket, R. I., by the common council appropriating $50,000 for the construction of sewers.

The mayor and general council of Atlanta, Ga., recently introduced an ordinance providing for a sewer from near Ormond street, along and in Crew street, to near Vassar street.

A bill appropriating $500,000 for the construction, maintenance and operation of a sewer system for the Mystic and Charles river valley, has been reported at Boston, Mass., by the committee on drainage.

A complete system of sewers will be constructed at Warren, Ohio, in both the west and east side. In addition, branch sewers will be constructed on portions of Chestnut, Thorn, East Market and Nile streets.

CONTRACTS TO BE LET.

Plans have been prepared at Medford, Mass., for a sewerage system.

Bids will soon be asked for constructing sewers in sundry streets at Meridian, Miss. I. A. Morser.

Plans for a sewerage system at Frankfort, Ind., are completed. A. J. Hammond, city engineer.

Bids will be invited, sometime during April, for the construction of about fifty sewers in Pittsburgh, Pa.

Bids are invited at Amsterdam, N. Y., until April 5 for constructing one mile of sewer extensions. F. E. Crane.

Sealed proposals will be received at West Newton, Mass., until April 5 for building one and one-third miles of brick and four miles of pipe sewer in sections 9 and 10 of the Newton sewer system. Address sewer committee of the city of Newton.

Bids are invited until April 6, at Peoria, Ill., for the construction of sewers in the Walnut street sewer district. Isaac Taylor, commissioner of public works.

Bids are invited until April 10, Fort Wayne, Ind., for the construction of 12, 15 and 18-inch clay pipe sewers in sundry alleys. F. M. Randall, city civil engineer.

The board of public works, Louisville, Ky., recently advised the city engineer to arrange proposals for bids for the construction of a great southwestern sewer to relieve the southwestern portion of the city.

Sealed proposals will be received by the president of the borough council, at Kittaning, Pa., until April 16, for the construction of a system of sewers. Potter and Folwell, engineers. Address G. R. Browne.

It is probable that new bids will be asked for in the Willow Run sewer at Covington, Ky. The city officials think that the bids received a few months ago are entirely too high considering the present circumstances in business.

Sealed proposals will be received at Chicago, Ill., until April 18, 1894, for the sixth letting for excavating that portion of the Main Drainage Channel, known as contract section one. Address board of trustees of sanitary district of Chicago.

CONTRACTS AWARDED.

The contract for the new Cedar street sewer, Muscatine, Ia., was awarded to Beckey, Hayde & Co., for $9,350.

Ten bids were received March 12 for the Georgia avenue sewer at Toledo, Ohio. Joseph McMahon was the lowest bidder.

The contract for sewer construction in Jamestown, N. D., was awarded to Johnson & Lindquist, of St. Paul, Minn., for $5,394.95.

The board of public works at Camden, Pa., awarded the contract for constructing a sewer in Seventh and Elm streets to Frank A. Ward.

The contract for constructing the new Oak street sewer, in Deering, Me., was awarded to Worster & Wilson, of that city. The length of the sewer will be 3,600 feet.

The Townsend Brick and Tile Company of Zanesville, Ohio, has been awarded the contract for a system of sewerage in the east side of the city of Aurora, Ill. Contract price, $179,375.

The contract for the construction of sewers in Boone, Ia., was awarded to Geo. J. Baer, of Kansas City, Mo. There were about twenty-five bidders, but on inspection only twenty-one bids were in proper form. The contract price is $70,604.98.

The contract for the construction of the internal sewer system of the Maple avenue district, Los Angeles, Cal., was awarded to Dalton Wheeler for $54,000. The sewers will consist of brick, cement and vitrified pipe, ranging in size from eight to twenty-seven inches.

Contracts for brick sewers have been awarded in Nashville, Tenn., as follows: Short street, Barnesfield & Deaderick, $1,119.25; Tenth ward, continuation of sewer, W. R. Dale, $1,663; sewer between McLemore, Spruce and Jefferson streets, W. R. Dale, $1,273; sewer between North Summer and North Cherry streets, John Broderick, $1,019.

The board of public works, Detroit, Mich., awarded contracts for lateral sewers, recently, as follows: Alley between Lincoln, Greenwood, Wilber and Baltimore avenues, Julius W. Hoeft, $949; alley between Wabash, Thirteenth, Hazel and Magnolia streets, James H. Stone, $557; alleys between Second, Cass, Colburn avenues and St. Antoine street, James H. Stone, $1,281; alley between Hooker and Woreford avenues, James H. Stone, $245.

Jacob Ritzmann, Buffalo, N. Y., was awarded the contract for constructing in that city a 5-foot 3-inch brick sewer and an 18, 15 and 12-inch tile sewer in McPherson street, from Hertel avenue to Amherst, and in Amherst to a point about 800 feet west of Delaware avenue. Contract price, $17,637. The contract for a tile sewer in Main street, between Oakwood and Forest avenues, and through Forest avenue to Lakir street, was awarded to Thomas H. Ryan for $3,733.

L. E. Brown, city engineer at Richmond, Ind., writes that the contract for a trunk sewer on South Eighth street was awarded March 16 to Denler, Scott & Bearrs, of Port Huron, Mich., at $5.88½. Richmond brick will be used. The sewer will require 3,700 lineal feet of 4½ foot, circular, two ring brick, average cut, 14.60 feet; 1,948 lineal feet of 4 foot, circular, two ring brick, average cut, 11.70 feet. Estimate includes 1,500 cubic yards rock excavation, 29 catch basins and 11 manholes.

B. R. Morton, city engineer at Newport, Ky., writes that contracts for the construction of sewers were awarded March 8, as follows: To W. J. & S. E. Irwin, Greenville, Ohio, nine contracts aggregating $30,384.35; J. Hastings, Newport, Ky., six contracts, aggregating $8,753.50: J. M. Peters, Cincinnati, Ohio, three contracts, aggregating $5,946.40; Ermert & Emory, Newport, Ky., two contracts, aggregating $1,763.98; Wilson & Strack, Cincinnati, Ohio, one contract, aggregating $1,102.75; W. W. Cook, Fostoria, Ohio, one contract, $875.

The selectmen at Beverly, Mass., awarded the contract for the new sewer to Franklin A. Snow, of Providence, R. I.

Langley & Jeynes were the lowest bidders for the Riopelle street sewer at Detroit, Mich., at $6.89 per foot, and $30 for manholes; S. Jeynes, Second street, at $4.99 per foot and $45 for manholes; F. Rank, Twelfth street, at $7.43, and $38 for manholes.

WATER-WORKS.

The system of water-works at Keithsburg, Ill., is completed. It cost $15,000.

The work of construction of the water-works system at Centralia, Ill., was begun March 7.

The proposition to bond Bellevue, Mich., for $20,000 for the construction of water-works was defeated.

A building for a filtering plant and a stand-pipe is being built at Knoxville, Tenn., at a cost of $33,000.

The water-works bonds at Pana, Ill., were sold to Deitz, Dennison and Pryor, of Cleveland, Ohio, for $39,151.

The city of Cedar Rapids, Ia., will purchase its water plant at the expiration of its twenty-year franchise, which expires in February, 1895.

More than nine miles of 10-inch service pipe are being laid in Dayton, which will, when completed, give the city a complete circuit of 10-inch service.

Luther Dean, Taunton, Mass., writes that the water department is having trouble with the suction pipe which has just been put into Assawampsett Pond. This is a 20-inch pipe which was run out into the pond so as to get pure water for the pump. The first pipe was put into the pond about seven months ago and they have been working there ever since. The coffer dam has given way a number of times while the work was in progress. They reported that they should begin to pump about the first of March. The pumps were started but would not work. They have now put a coffer dam around the outer end of pipe and are trying to pump water from there, so as to find out where and what the breaks are.

CONTEMPLATED WORK.

Milan, Ill., wants a system of water-works.

Jamestown, Ohio, voted favorably for water-works.

Bloomfield, Neb., contemplates a system of water-works.

A system of water-works is contemplated at Fairfax, Minn.

A system of water-works is contemplated at Farmville, Va.

A system of water-works is contemplated for Alexis, Ill.

Penn Yan, N. Y., voted favorably for water-works March 8.

Ashland, Ill., contemplates building a system of water-works.

The water-works question is being agitated at Clear Lake, Ia.

A system of water-works has been suggested for Memphis, Mo.

Platteville, Col., contemplates a system of water-works this year.

A system of water-works will be put in at Barron, Wis., this spring.

A system of water-works is being contemplated at Hastings, Neb.

The question of water-works is again being agitated at Turner, Ill.

A system of water-works to cost $20,000 is proposed at Sheldon, Iowa.

A system of water-works is contemplated at Grand Junction, Colo.

Woodstock, Ill., contemplates issuing bonds and building water-works.

Alden, Minn., contemplates putting in a system of water-works this spring.

Waupun, Wis., contemplates the construction of a system of water-works.

The water-works question is still receiving consideration at Farmington, Ill.

A system of water-works to cost about $9,000 is contemplated at Shannon, Ill.

The citizens of Earlville, Ill., contemplate the construction of a water-works plant.

Plans and specifications have been prepared for a system of water-works at Batavia, Ill.

A special election was held March 14, for the proposed water-works system at Thomson, Ill.

An expenditure of $30,000 is contemplated this spring for water-works at Cheboygan, Mich.

A system of water-works will be constructed in the village of Manton, Mich., this spring.

The city council of Portsmouth, Iowa, will take steps toward getting a system of water-works.

Fullerton, Neb., again contemplates bonding the city for $13,000 for a system of water-works.

A system of water-works is contemplated at Danville, Ky. Address water works committee.

The village of Shannon, Ill., contemplates the construction of water-works. Address W. H. Barron, city clerk.

The city council of Mt. Sterling, Ill., will submit to vote, April 17, the question of constructing water-works in that city.

Arlington Heights, Hamilton county, Ohio, will vote again, this spring, on the issuance of bonds for a water-works plant.

An extension of water mains will be voted upon at Lyons, Kan., this spring. The cost of the extension is estimated at $10,000.

An ordinance was introduced in council recently at Beaver Falls, Pa., submitting to vote the right to borrow $125,000 to build water-works.

A system of water-works is contemplated at St. Charles, Minn. A proposition to vote $12,000 for water-works was submitted to the voters a few days ago.

The city of El Paso, Texas, is taking steps for building and equipping a municipal system of water-works. The city's present contract expires in two years.

A system of water-works is again being considered at Gallatin, Mo. The question has been before the people for some time but nothing definite has been done.

The feasibility of piping water from Clearwater river, Red Lake Falls, Minn., to Grand Forks is being considered at Grand Forks. The distance is thirty-six miles.

It has been suggested that parties interested in the erection of water-works, visit Demopolis, Ala. A recent disastrous fire in that place has aroused an interest in the matter.

A new water-works system is contemplated at Steubenville, Ohio. The city council has decided to submit to vote the issuance of $175,000 worth of bonds for that purpose.

Mr. J. M. James, Sioux Falls, S. D., writes that the city contemplates the purchase of the water-works plant. The city council has appointed W. L. Dow, Esq., appraiser of same.

C. B. Channel, city engineer at Kearney, Neb., writes that an ordinance has been passed submitting a proposition to vote $15,000 of 5 per cent. twenty-year bonds for the construction of a system of water-works.

Eugene Kirk, Youngstown, O., writes that the question of extending and improving the city water-works by purchasing two new engines, erecting two large stand-pipes and connecting the necessary mains therewith and issuing $186,000 worth of bonds, will be voted on at the next election, April 2.

An election will be held April 17 at Pender, Neb., on $10,000 water-works bonds, to bear 6 per cent. interest.

J. Alcide Chaussé, Montreal, Can., writes that the construction of water-works is under consideration at Stadacona, Que.; also, that the estimated cost of a complete system of water-works for the town of Levis, Que., is about $150,000. No action in the matter has been taken yet.

CONTRACTS TO BE LET.

Sealed bids are invited at Delphi, Ind., until April 3, for furnishing and laying 1,500 feet of four-inch water mains. C. A. O'Brien, agent water-works committee.

Bids are invited until April 9, for constructing, at Fort Ethen Allen, Burlington, Vt., a pump-house and pumping plant, complete. Address Capt. Guy Howard, Assistant Quartermaster, U. S. A.

Bids are invited until April 3, at Winchester, Va., for the construction of water-works. The plans and specifications for this system were prepared by Mr. Alexander Potter, of Pittsburgh, Pa. Address C. E. Hoover.

Sealed proposals will be received until May 1, at Lancaster, Ky., for the construction of a system of water-works. Specifications and requirements can be obtained from Fred Balcom, 627 Walnut street, Philadelphia, Pa.

CONTRACTS AWARDED.

A system of water-works will be put in at Plain, Iowa, by Mr. Thos. Botham, for $16,650.

G. W. Dudley, St. Louis, Mo., was awarded the contract for putting in water-works at Bolivar, Mo.

C. A. Stookey, Belleville, Ill., secured the contract for constructing a system of water-works at Pana, Ill., for $35,300.

The contract for constructing a system of water-works at Caledonia, Minn., was awarded to Turner & Co. for $5,500.

E. T. Sykes, of Minneapolis, Minn., was awarded the contract for putting in a water-works plant at Waseca, Minn., for $28,230.

Goodenow & Winter, Granite Falls, Minn., secured the contract for putting in a system of water-works at Clara City, Minn.

The contract for constructing a system of water-works at Lebanon, Ind., was awarded to Bynum, Benton & Fall, of that city, for $47,885.

Mr. Fred Davenport, Jacksonville, Ill., writes that a contract has been awarded the American Well Works, of Aurora, Ill., for sinking an artesian well 2,600 feet in depth. Contract price, $11,460.

The contract for the construction of a system of water-works at Martinsville, Va., was awarded to the Virginia Construction and Paving Co., for $27,000.

A franchise has been secured by L. G. Hallock and A. L. White, Wheeling, W. Va., for a system of water-works in Lonaconing, Md. Hoge & White, of Wheeling, who are preparing the plans, will superintend the work of construction.

The contract for constructing a system of water-works at Orrville, Ohio, was awarded to H. D. Shannon of that city for $20,324. The engineer's estimate was $21,490. Mr. Alexander Potter designed the system. Gordon compound duplex pumps, Mathews hydrants, Ludlow valves, and Lake Shore Foundry pipe will be used. Bids on the pipe ranged from $17.55 to $21.50 per ton.

BRIDGES.

A new iron bridge will be constructed at Cicero, Ohio, this spring.

A new county bridge will be built over Little Sugar creek, at Cochranton, Pa.

The city of Galion, Ohio, contemplates the construction of an extensive viaduct.

A new wagon bridge is ing contemplated across the Mississippi at Hastings, Minn.

C. L. Rose & Co. secured the contract for all bridge work during 1894, in Adams county, Neb.

The bridge at Turner, Kansas, will be constructed at once. This bridge has been talked of for a long time.

The new bridge which is being constructed over East river at Two Rivers, Wis., will be completed about April 15.

A bill has been passed in the Ohio legislature providing for a bridge across Gregory's creek, in Lemon township, Butler county.

Unger & Westergren, of Golden, Col., secured the contract for building a new bridge across Clear creek at Boyd's Crossing for $403.

A new iron bridge has been completed across Mussell Fork, near Bucklen, Mo. The St. Joseph Iron and Bridge Co. had the contract.

The iron bridge over Cane river at Natchitoches, La., is completed. The bridge was built by the Youngstown Bridge Co. at a cost of $15,500.

The commissioners of Crook county, Ore., are contemplating the construction of a bridge across the Des Chutes, near the Warm Springs agency.

The board of county commissioners accepted the Fourth street bridge and viaduct at Pueblo, Col., March 2. The bridge and viaduct cost $38,750.

The contract for the construction of the Front street viaduct, Columbus, Ohio, was awarded to the Edgemoor Bridge Works, Edgemoor, Del., for $54,000.

McGrath & Anderson have completed the bridge across East river between the towns of Allouez and Bellevue, Mich. The cost of the bridge was $2,000.

A bill has been introduced in the Ohio legislature permitting the construction of two bridges in Hamilton, Ohio, at Main and High streets, over the Great Miami river.

A three-span, combination wagon bridge will be constructed across the Mississippi river at Little Falls, Minn. The Pine Tree Lumber Company, of that city, has the contract.

The bridge across Duncan creek, near Chippewa Falls, Wis., is completed. The bridge was rebuilt by M. Wall & H. Hall, and is pronounced a fine and complete structure.

The county commissioners of Flat Head county, Mont., awarded to the Gillette-Herzog Mfg. Co., of Minneapolis, the contract for constructing a steel bridge across Flat river at Kalispell.

The county commissioners of Trumbull county will build a bridge over the Mahoning river at South street, Warren, Ohio. The bridge will be 210 feet long and 20 feet wide, including a sidewalk.

The new iron foot-bridge being constructed in Lincoln park, Chicago, will cost, when completed, $20,000. The park authorities have in contemplation the building of a stone viaduct to replace the little tunnel west of the Grant monument.

Sealed plans, specifications and strain diagrams and bids will be received until March 10, 1894, for the construction of a bridge and approaches across the John Day river at Monument, Ore., on the wagon road leading from Hamilton to Heppner. G. I. Hazeltine, county judge.

O. R. Ranchfuss, city engineer at Joliet, Ill., writes that the township highway commissioners have let the contract for a highway bridge just outside of city limits across Spring creek to the Massillon Bridge Company. The masonry was let to R. C. Morrison, of this city, for $4.10 per yard.

Sealed proposals will be received until April 5, at Lincoln, Neb., for the material and labor necessary for the construction and completion of all pile bridges that may be necessary in Lancaster county during 1894. J. H. Westcott, Chairman Board County Commissioners, Lincoln, Neb.

A committee of three members of the city council at Ashtabula, Ohio, will meet and confer with the county commissioners at their next regular meeting, which is in April, regarding the construction of a high level bridge. Three sites are named for the bridge, viz.: Spring, Bank and Booth streets.

The Wrought Iron Bridge Company of Canton, Ohio, was awarded the contract for an iron wagon bridge over the North Fork of Sun river, at Great Falls, Mont. The company presented two bids. One $7,500 for a bridge of 1,000 pounds per linear foot live load capacity; the other was $7,700 for a bridge of 1,280 pounds per linear foot, live load. The latter was accepted.

A movement is being made to construct a high level bridge over Rocky river at the Mastik Hills, so that the farmers will have bridge service, in all seasons of the year, to get to Cleveland, the present bridge being impassable during a freshet. If constructed, the new bridge will be eighty feet above the level of the river and will be 2,000 feet long. The estimated cost is $134,000.

PUBLIC PARKS.

A boulevard will be constructed by private parties in the valley which lies between Wade and Gordon parks, Cleveland, Ohio.

The park committee of the common council at South Bend, Ind., is negotiating for the purchase of additional territory to be annexed to the city park.

Mr. George W. Breckenridge, of San Antonio, Tex., but formerly of Boonville, Ind., has presented that town two and one-half acres of ground in the southwestern part of the town on condition that it be converted into a park.

The organization of a park and pleasure driveway district has been voted favorably upon at Peoria, Ill. Although two hundred acres of land are offered free for park purposes, a great deal of opposition was shown in the election. The new district includes all of the city and part of South Peoria, North Peoria, Averyville and Richmond townships. Seven park commissioners will be elected.

The architects and engineers of St. Louis, Mo., have asked the co-operation of the various exchanges in the city in pushing forward the work of constructing boulevards. President Wm. G. Boyd, of the Merchants' Exchange, appointed a committee of five members to act in connection with other committees. The representatives appointed are: D. R. Francis, Charles Parsons, George H. Small, John W. Kauffman and F. N. Judson.

The birth-place of Abraham Lincoln in La Rue county, Ky., will be converted into a park if the party of Kentuckians that is trying to purchase it is successful.

STREET RAILWAYS.

An electric railway has been proposed between Mount Holly and Burlington, N. J.

An electric line will be built in Freeport, Ill., by C. E. Loos & Co., of Chicago, to take the place of the horse car system.

Charles Corliss, of Haverhill, Mass., is planning to build a double track electric street railway from Haverhill to Nashua, N. H.

The Middletown-Goshen Traction Co., of Middletown, N. Y., has applied for permission to construct a road through the town of Goshen.

A number of capitalists of Oregon, Dixon and Rockford, Ill., have organized a company for the purpose of constructing an electric line from Dixon to Rockford.

Sealed proposals will be received until March 19, 1894, for the construction and operation of a street railway over routes 1 and 2, in Marion, O. James Williams, city clerk.

The Clayton and Creve Cœur Railway Company has applied to the county court for a franchise to construct and operate an electric line from Clayton, Mo., to Creve Cœur Lake.

J. Alcide Chausse writes that the York county council has granted permission to the Metropolitan Street Railway Company of Toronto, Ont., to extend their line to Richmond Hill.

The Highland Street Railway Company has been incorporated at Westfield, Mass., for the purpose of constructing and operating a street railway two and one-half miles in length. The track will be laid within a year.

The incorporators of the Ohio Inter-Urban Railroad Company, at Cleveland, O., are: James L. Mauldin, James B. Christ, Clayton Chapman, C. L. Saunders, Frank J. Lewis and William B. Scorer. The object of the company is to build and operate an electric railway, but the route has not yet been made public.

A meeting was held by the stockholders of the Lancaster Electric Street Railway Company, at Lancaster, O., last month, when it was decided to make an assessment on the stock to discharge the old debt of the company and build and equip the electric street railway and put it in operation. The officers elected were: Wm. Duffy, president; Dr. G. Mussee, vice-president; C. F. Nestor, secretary; A. Bauman, treasurer and manager.